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February 1986
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Tuning Up Your Apple

INSIDE:

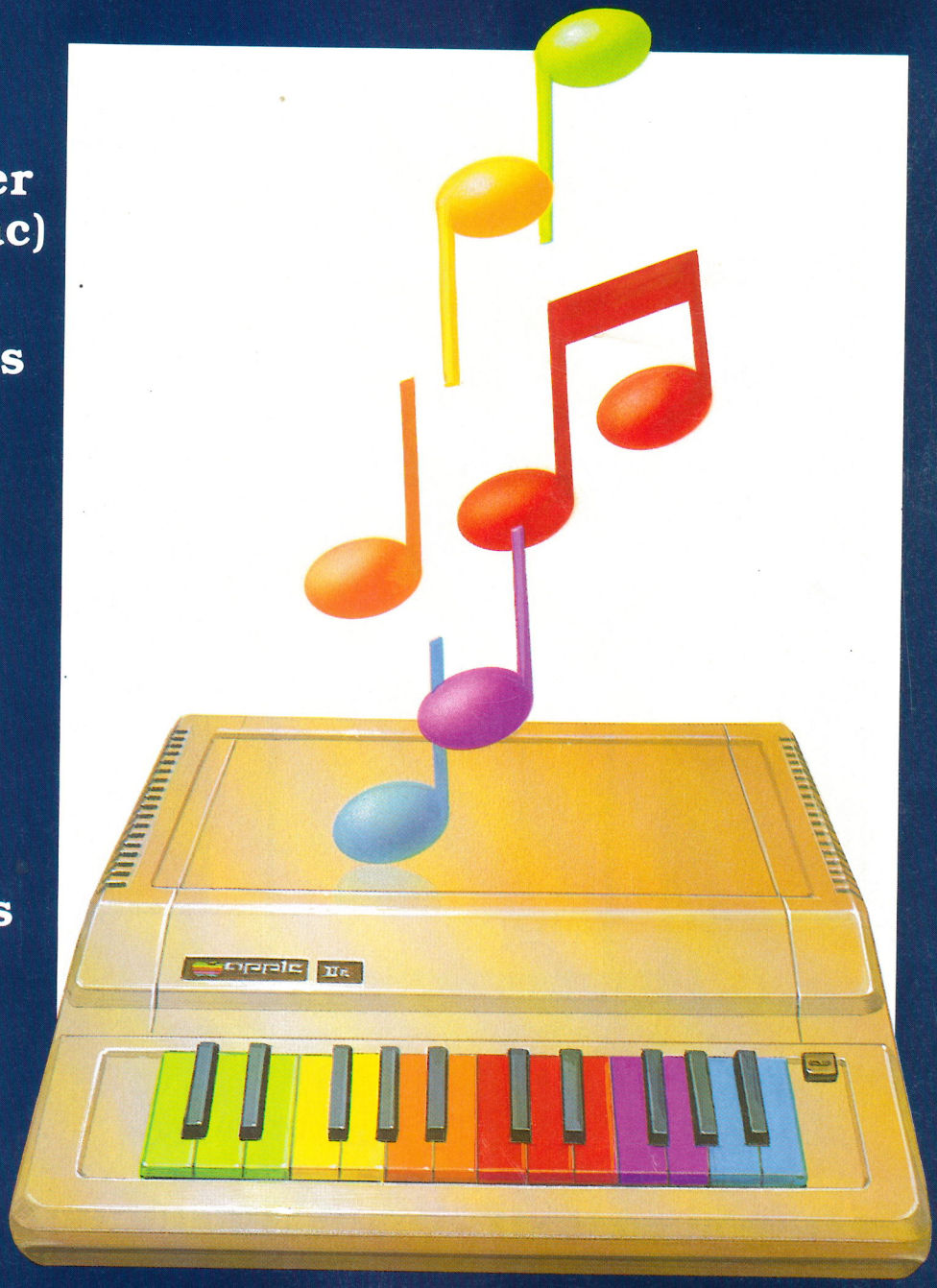
- Well Tempered Music Synthesizer (for Apple II & Mac)
- Computing Tax Sheltered Savings
- Undeleting ProDOS Files

REVIEW:

- "Assembly Cookbook"

PLUS:

- More on ProDOS Assembler Macros
- Hardware and Software Tips, New Products, and more. . .



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Apple PugetSound Program Library Exchange

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VOLUME 9, NUMBER 2 FEBRUARY 1986

Official Publication of **A.P.P.L.E. Co-op** "People Helping People with Personal Technology".

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FEBRUARY 1986
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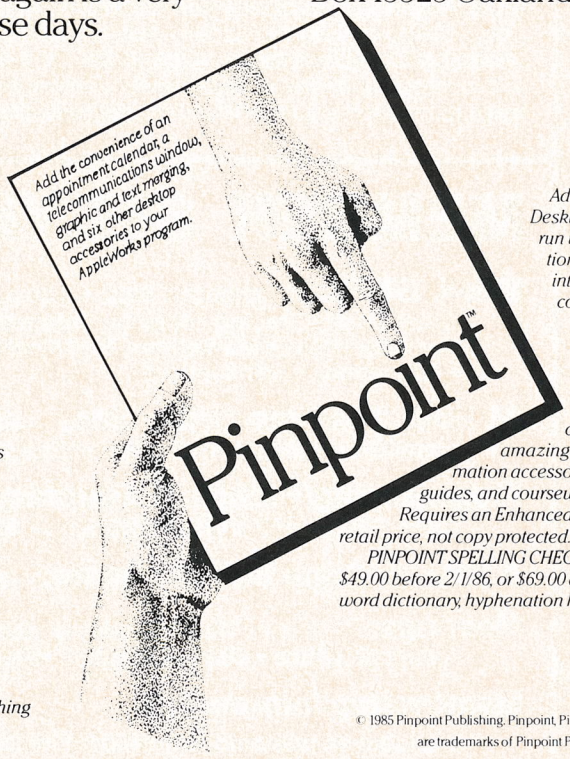
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The INNER CIRCUIT

Don Elman

The Well-Tuned Computer

Do you know why February is the shortest month? Here's my theory: With the joyous, year-end holidays well behind us, the dreariness of winter dragging on past the point of endurance, and the hope of spring still several weeks off in the distance, what better month is there to get over with as quickly as possible? On the other hand, all these drawbacks to this time of year are also excellent reasons to sit down with your Apple and really have some fun. Silence your word processor, fold up your spreadsheet, and consider what else the computer can do to lift your spirits before the short month is out!

One of my favorites is making music. Given the proper peripherals and software, a microcomputer can be one of the most versatile musical instruments ever created. Unlike a flute or a cello, the computer is not limited in tone by its physical construction. Harnessing the incredible speed of its internal electrical cycles, this single instrument can produce on demand an infinite variety of audible pitches and waveforms. It's too soon to tell whether the electronic music synthesizer will make traditional instruments obsolete, since many of them have survived for hundreds or thousands of years. But we're confident that this new form of musical device is here to stay and will continue to expand the range of sound-generating possibilities.

In This Issue

Our opening piece this month, **Your Well Tempered Music Synthesizer** by William Dolen, starts with a fascinating blend of music history and theory, and then presents programs that can turn your Apple II (with synthesizer) or your Macintosh into a unique keyboard instrument. On the more practical side, **Tax Sheltered Savings Benefits** by Gerhald Hansel gives us an application program that may come in handy this season. **ProDOS Undelete** by Wes Felty not only provides a convenient utility for "undeleting" files, but also helps to explain the process of reading and writing on a ProDOS disk.

We continue with the second parts of two series that began last month–**ProDOS MLI & Assembler Macros** by Ken Kashmarek, and **A Lab Instrument Interface** by David Gregg and Daniel Macero. Also, Michael Ching reviews Don Lancaster's **'Assembly Cookbook for the Apple II/IIe'**. We hope this medley of features–along with our regular chorus of departments, letters, and columns–will strike a chord that helps to brighten your month, no matter how long it seems.

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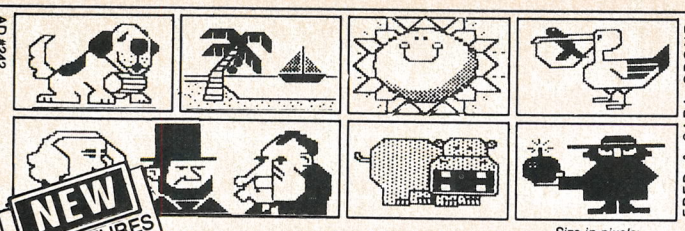

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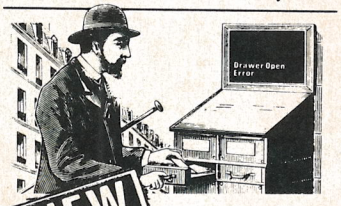

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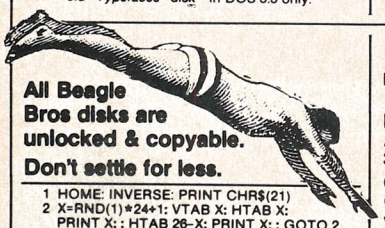

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This is for all the power users technologies before they

Other than Steve Wozniak and Jonathan Rotenberg, there are probably only 2,998 personal computer users who qualify as trend setters. They're the people who owned Apples® when everyone else thought Apple® was a record label. People who were called hackers when a hacker was someone no one wanted to play golf with.

However many of you there are, this ad is for you. It's been designed and written to introduce you to a new technology without using superlatives or words like revolutionary. (We're saving those words for future ads targeted at the general consumer.)

The new technology is called the Softstrip™ System. This ad tells you what it's all about.

THE SOFTSTRIP SYSTEM ENCODES DATA ONTO PAPER.

Softstrip technology allows text, graphics, even digitized sound to be encoded on a strip of paper. Providing an alternative to magnetic media and telecommunications for the recording, distribution and retrieving of information.

These data strips, each a structured pattern of black and white rectangles that look something like a condensed bar code, can be encoded with special software and read with a scanning device called the Cauzin Softstrip System Reader. The reader optically scans the strip, translates its contents into 8-bit code and feeds it into a personal computer's serial or cassette port, enabling automatic, error-free entry of printed data without using a keyboard.

One Softstrip data strip, typically 5/8" x 9 1/2", can contain up to 5,500 bytes of information. (For example, you could fit this entire ad on two strips.)

Strips can be printed by using a photographic negative (ideal for book and magazine publishers), or by using a laser or dot matrix printer and special software (appropriate for personal or business use).

If you want, you can generate strips that can be reproduced on a copier or versions that can't be. Either way, any data strip, whether it's printed in a newspaper, magazine or personal letterhead, can survive pen marks, scratches, even coffee stains.

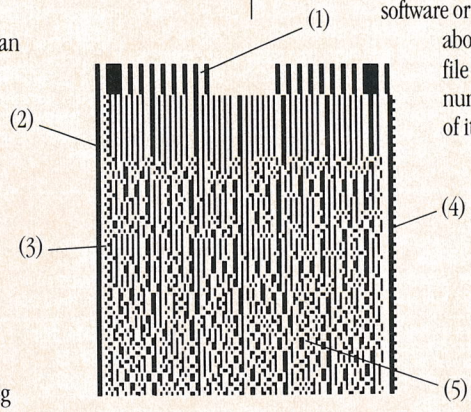
Basically, anything you can put on a magnetic disk you can put on a Softstrip data strip, which should suggest numerous application possibilities.

Starting in the next two months, data strips will appear in magazines, journals and books. These strips will contain program listings, tables of contents, new product demonstrations and data.

Eventually, strips may be used for everything from bank statements to sheet music.

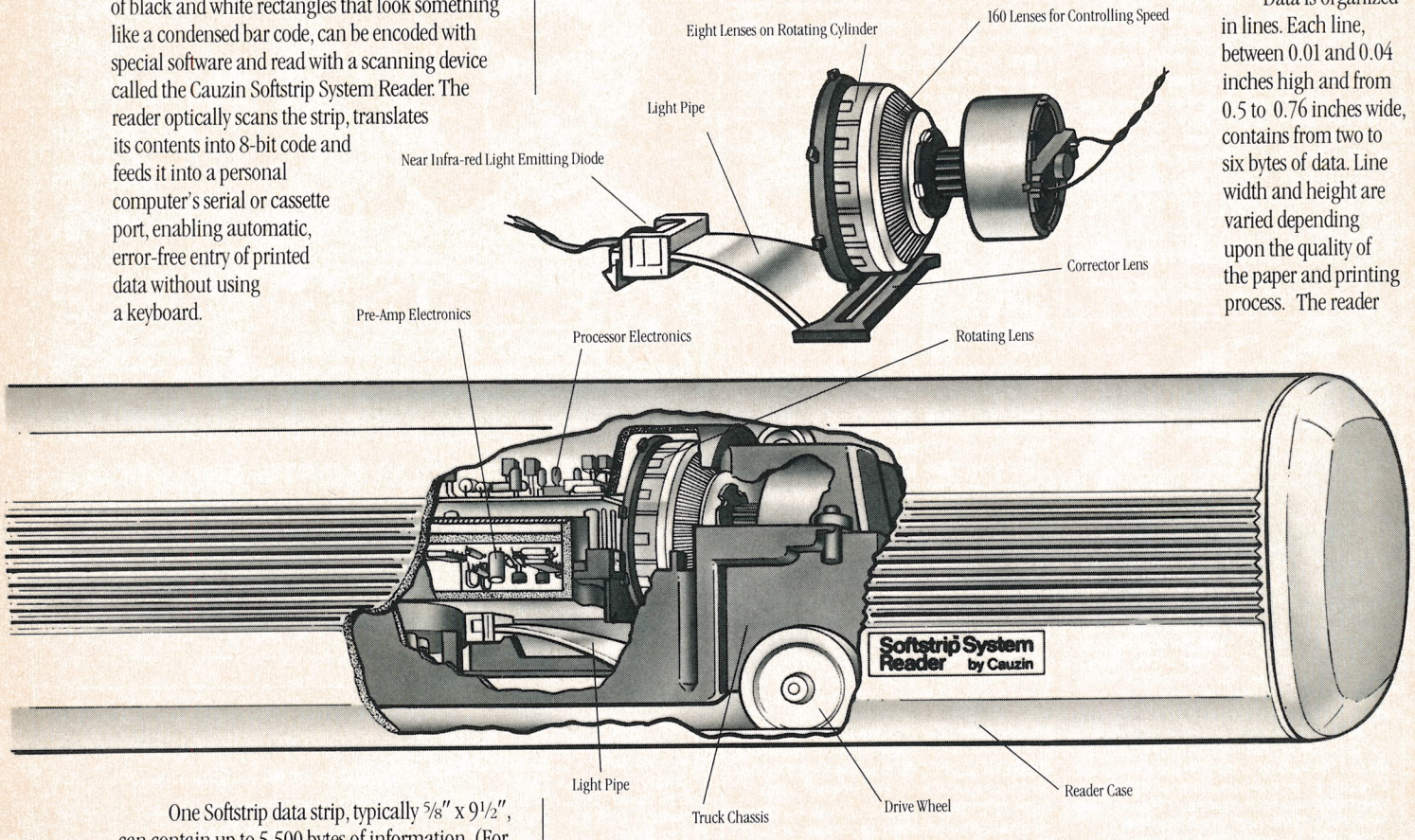
THE ANATOMY OF A STRIP.

A Softstrip data strip contains not only software or data, but also information about its content, including file types, file name and the number of strips. Because of its inherent technology, strips are as accurate as any magnetic medium. And they can be entered into an IBM PC,® Apple II® or Macintosh® computer using the same reader with only slightly modified communications software.



Strips encode data bit by bit using highly structured optical patterns. The bits are each composed of two rectangles called di-bits. They function as optical on/off signals. White/black equals 1. Black/white equals 0.

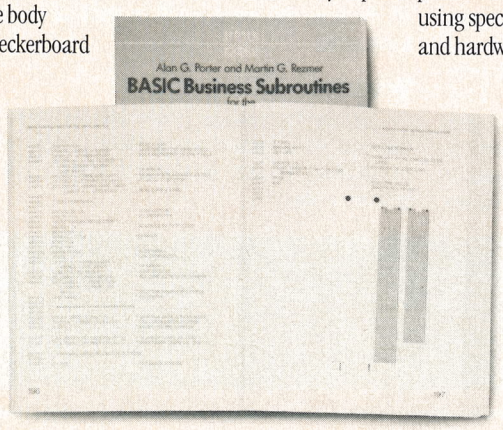
Data is organized in lines. Each line, between 0.01 and 0.04 inches high and from 0.5 to 0.76 inches wide, contains from two to six bytes of data. Line width and height are varied depending upon the quality of the paper and printing process. The reader scans each data line with a series of raster scans 0.0025 inches apart providing between four and sixteen scans per line.



who want to know about new become household words.

A close-up view of a strip reveals five distinct sections. The header (1) at the top tells the reader the number of bytes in a line, the height of each line, and the paper to ink contrast level. Running vertically down the sides of the strip are the startline (2), the checkerboard (3) and the rack (4). They identify the boundaries of every horizontal line to be read. They also work in tandem to feed the reader alignment information.

Contained within the body of the strip, between the checkerboard and rack, is the file's data area (5).



Strip data accuracy is checked and error correction is provided by parity bits at the beginning and end of every data line, as well as by a strip checksum. There is also an optional 16 bit CRC. Combined, this design results in an undetected bit error rate of less than one bit error per 10,000,000,000 bits.

IT TOOK GUTS TO BUILD THE READER.

Rated for 25,000 reads, the reader is an equally impressive technology. It's composed of two key components: the case and the truck. While the case sits still, the truck moves uniformly down the length of the strip making a complete scan of the strip's di-bit lines every 0.0025 inches.

As the truck moves down the strip, it tracks its own lateral movement within five microns. Alignment is controlled by two servo mechanisms. As the truck moves, it illuminates the area to be scanned using near infra-red light beamed through a light pipe. (The infra-red technique permits the reader to see through colors, stains, and spills.)

The reader's optical scanning system, containing eight rotating cylindrical lenses and an aspherical corrector lens, forms an F.12 optical system with a depth of field between 0.05 and 0.08 inches. A set of 160 additional cylindrical lenses on the rotating lens allow the system to control scanning speed.

Inside the reader, the mechanical system uses six AGMA-7 high precision plastic molded gears to provide very accurate truck movement. One gear system even allows for a 4000 to 1 angle reduction with no backlash for corrector lens alignment.

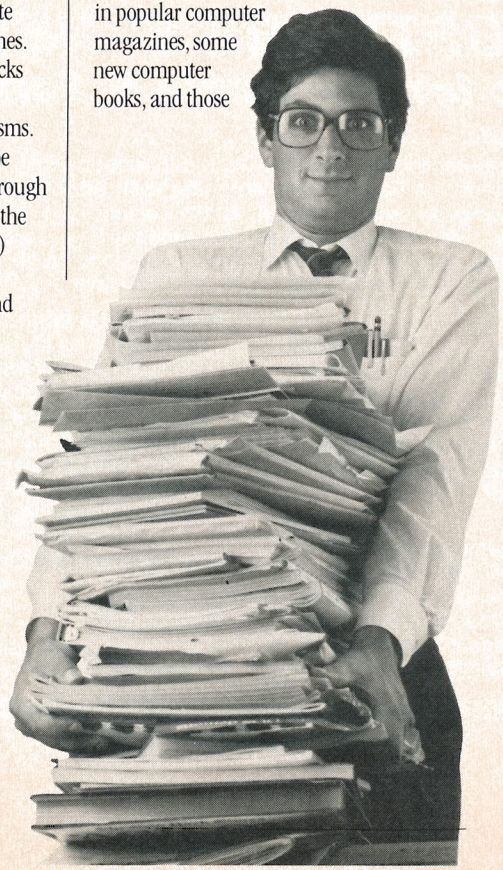
A TMS 7040 8-bit processor and Cauzin's own custom VLSI chip provide reader logic, control and communications using four nested phase locked loops and several hardware and software servos. The reader transmits data to the host at 4800 baud burst rates with throughput of 1500 baud.

HOW TO CREATE YOUR OWN STRIPS.

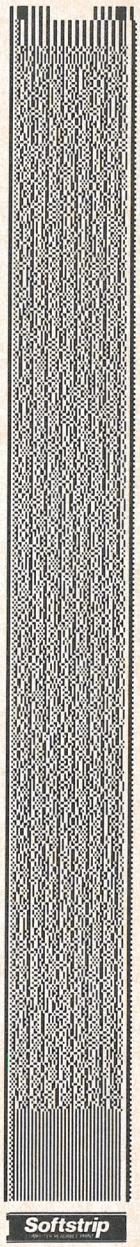
There are two ways to create Softstrip™ data strips. For large volume and greater density – up to 5500 bytes per strip – a film negative is created using special Cauzin software and hardware. This is ideal for book, magazine, newsletter, data base and commercial software publishers who can reproduce a strip in volume using web, offset, gravure or similar processes.

For personal or business applications, 500 to 1000 byte strips can be generated using Cauzin licensed software on dot matrix printers; up to 3400 byte strips can be generated using other Cauzin licensed software and laser printers.

In the next few months, you should start to see data strips appear in popular computer magazines, some new computer books, and those consumer ads we told you about earlier. They'll look exactly like the working strip you see here, a medium density strip with an ASCII text file on it.



Of course you'll be able to purchase a reader at most computer dealers. They'll be selling for about $200.00. Contact your dealer soon for a demonstration. Or call us directly at 203-573-0150.



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New Purchase Policy for Non-members

In the early years of A.P.P.L.E., the policy was established of restricting product purchases to active members only. For a local user group, this policy made sense because the power of group purchasing depended on continuous communication among the interested users, both to choose which products to buy and to notify everyone when they became available. At that time our group was one of the few sources, if not the only one, for many types of software and hardware.

More recently—recognizing both the changing market environment and our own maturation into an international retail and publishing operation—we have experimented with making our products available to non-members under certain conditions. *Call -A.P.P.L.E.*, for example, is now sold without full member privileges in a growing number of retail outlets and by subscription. In the past year, we have allowed non-members to make a one-time purchase of products, as a way of sampling the benefits of membership before deciding whether to join. However, this approach has proven less than satisfactory because it is difficult to enforce and to apply fairly in every case.

As of the current catalog (Fall/Winter '85-'86), we will allow non-members to purchase products without limitation, subject to standard payment terms, at 10% above advertised member prices. Of course, non-members cannot receive such valuable services as free Hotline support, nor do their purchases count toward a share of co-op dividends. By increasing the volume of potential sales, however, we believe this policy will benefit all members and customers in the long run.

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At our December 1985 club meeting, the Reader's Choice reply Card of B. Granger from Wales, MA was drawn, winning a $100 credit toward any product in the A.P.P.L.E. Co-op catalog. Congratulations!

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Your Well Tempered Music Synthesizer

William K. Dolen

MANY microcomputers, like the Macintosh, have sophisticated built in musical capability; and others, like the Apple II, can become an electronic orchestra with the addition of peripherals such as the ALF cards, MIDI interfaces, or the Soundchaser and Syntauri systems. Although writing effective software for any computer music system requires a sophisticated knowledge of the mathematics of music, particularly for calculating tuning intervals and designing complex waveforms to simulate the sound of various musical instruments, technical information for doing so is not widely available.

Note that Macintosh Microsoft BASIC 2.0 has a SOUND statement with a frequency parameter. To use it, you must know which musical frequency to assign to a given note of the scale. Even though this version of BASIC can generate tones within the entire range of the Mac, including notes "in the cracks" between piano keys, the manual only provides frequencies for a few notes of the equal tempered scale. The Soundchaser Turbo Traks program likewise has the flexibility to allow rapid retuning of the keyboard, but comes without software to do so. In either case, it is possible to use ancient, unusual, and innovative methods of instrumental tuning for performance, experimentation, or instruction.

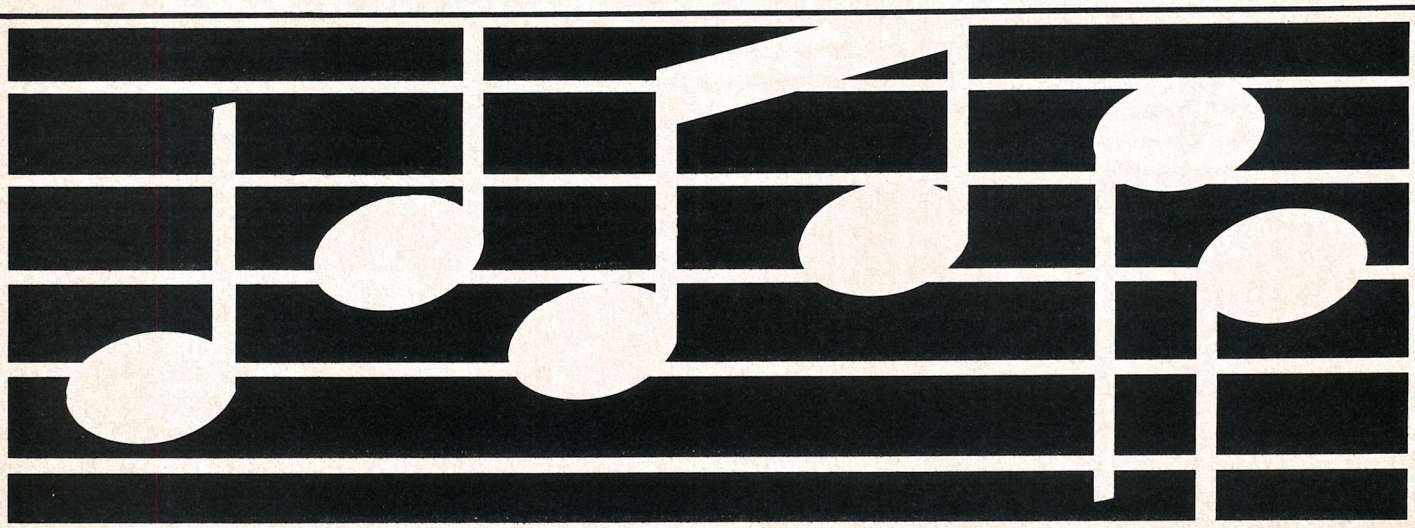
The purpose of this article is to show you how to tune your computer using two short programs. One, written in Applesoft, will create tuning files compatible with the Soundchaser "Turbo Traks" software. The other, written in Macintosh Microsoft Basic 2.0, will calculate tuning frequencies for inclusion in music programs such as that by Dennis Brothers on Compuserve, or the music demonstration program on the new MBASIC disk.

More Than Twelve Notes For The Octave

Most musicians know that middle A normally has a frequency of 440 Hz, but few are aware that G sharp is not necessarily the same note as A flat. These notes share the same key on a piano or other modern keyboard instrument only because of a centuries-old compromise, called equal temperament, which results in all intervals (except the octaves) being equally out of tune. As a result, all of the thirds are sharp , and all of the fifths flat. Some method of temperament is necessary because of an interesting phenomenon. If you start with a C and tune perfect fifths above it in the progression, C - G - D - A - E - B -F# - C# - G# - D# - A# - E# - B#, it would seem that the ending B# should be the same note, give or take a few octaves, as the beginning C. They actually differ by a small, but very noticeable, amount called the ditonic comma, which must be divided up among the other notes so that the octaves are perfect and the other intervals sound good. The problem of how best to divide the comma among the notes of the scale has perplexed musicians for centuries, and has been the subject of many heated debates.

Cutting Up The Comma

The ancient Greeks largely ignored the comma, often tuning their instruments in mathematically perfect, natural intervals, like the perfect consecutive fifths of the Pythagorean scale. This resulted in very sharp thirds, and as music became more complex, it became apparent that these so-called "perfect" intervals sounded terrible. Ptolemy's diatonic scale, a version of "just intonation" described in *Inside Macintosh,* attempted to compromise between mathematics and musical sense. His octaves, fifths, fourths, and thirds were pure, but the other intervals weren't good and the system only worked in and near the musical key of C.



Mean temperament, a later development widely used for keyboard instruments until the early eighteenth century, provided nearly perfect thirds and slightly flat fifths, but also worked only in keys closely related to the key of C. The pitches usually chosen for the 12 keys in the octave were C, C sharp, D, D sharp or E flat, E, F, F sharp, G, G sharp or A flat, A, B flat, and B. You will almost never see a D flat or A sharp in keyboard music from this period (unless it has been transposed) because the use of these notes would have required retuning the instrument. They also weren't needed, since chords using them are far removed from the key of C. The choice of D sharp vs. E flat, or G sharp vs. A flat was more difficult. Modulating to an E major chord on an instrument tuned with A flats produced a discrepancy called the "wolf," presumably because of the howling dissonance that resulted. Some composers wrote intentionally dissonant passages using the wolf, and some keyboard instruments were built with more than twelve keys in the octave. The usual solution, however, was to tune the instrument as needed for each piece in a concert.

Although Silbermann, the great German organ builder, used a version of mean temperament for his magnificent instruments, Bach emphatically (and vociferously) favored a system of "well temperament," which divided the octave into twelve more or less equal parts so that the same keys could be used for C sharp and D flat, and so on, without the need to retune the instrument. The 48 preludes and fugues of the Well Tempered Clavier, like most of Bach's keyboard works, could not be played on an instrument in mean temperament. Try it sometime if you don't believe me. The presently used system of equal temperament divides the octave into twelve mathematically equal parts. Although described almost four hundred years ago, its use for keyboard instruments is relatively recent; it is not the same as Bach's well temperament. The intervals produced by equal temperament are out of tune, but they are not hard to get used to and allow performance in all keys. A modern modification of equal temperament is the quarter tone system, which uses 24 equal octave divisions, but is not particularly easy to implement on a conventional keyboard instrument. For purists who want absolutely perfect sounding chords in all keys, there is also a system in which the octave is divided into 53 equal pieces. Imagine how difficult it would be to play this keyboard!

Calculating Musical Intervals

If your task as a programmer were to divide the octave into twelve mathematically equal parts, if middle A had a frequency of 440 Hz, and if the A an octave above it had a frequency of 880 Hz, then it seems that the interval of a half step would be (880 - 440) / 12, or 36.7 Hz, and that the B flat above middle A would be 440 + 36.7, or 476.7 Hz. Unfortunately, the mathematics is not that simple, for the relationship is actually exponential. To make musical calculations easier, acousticians divide the octave into 1200 equal logarithmic units called "cents," so that 100 cents are an equally tempered semitone and 50 cents equal a quarter tone. All of the intervals of the historical tunings and temperaments can be expressed in terms of cent units, so any programmer devising a routine for playing a computer instrument in other than equal temperament (and all computers should be able to play in any desired tuning or temperament) should allow the user to input the appropriate intervals in cent units.

Given a frequency such as A = 440 Hz, calculating the frequency 100 cents above it (A sharp / B flat in equal temperament) is a task not for paper and pencil. Let your computer do it. The formula for frequency calculations, written in a BASIC format, is as follows:

```
NewFreq = EXP (CENTS * LOG (2) / 1200) * OldFreq
                    or
NewFreq = 2 ^ (CENTS / 1200) * OldFreq
```

Thus, in the problem above, the frequency for the B flat above middle A (an equally tempered half step is 100 cents) is 2 ^ (100 / 1200) * 440, or 466.16 Hz. The frequencies for an equally tempered octave, as well as for some of the historical temperaments, are given in Table 1.

TABLE 1. FREQUENCY VALUES, ADJUSTED TO A=440 HZ, FOR VARIOUS SYSTEMS OF TUNING AND TEMPERAMENT.

	EQUAL	PYTHAGOREAN	JUST	MEAN	SILBERMANN
C	261.63	260.72	260.72	263.18	262.38
C#	277.18	278.47	274.95	275.00	276.22
Db	277.18			281.60	
D	293.66	293.33	293.33	294.25	294.00
D#	311.13			307.46	
Eb	311.13	308.98	312.93	314.83	312.93
E	329.63	330.01	325.84	328.98	329.44
F	349.23	347.62	347.62	352.00	350.64
F#	369.99	371.28	366.59	367.81	368.93
Gb	369.99			376.63	
G	392.00	391.09	391.09	393.55	392.68
G#	415.30	417.71	412.44	411.22	413.39
Ab	415.30			421.09	
A	440.00	440.00	440.00	440.00	440.00
A#	466.16			459.76	
Bb	466.16	463.48	469.41	470.79	468.32
B	493.88	495.03	488.77	491.94	493.03

Listing 1

```
REM  CONVERSION FROM CENT INTERVALS TO FREQUENCIES
REM  William K. Dolen
REM  Microsoft Basic for the Macintosh, Version 2.0

DIM TBL(12)

   C = 262:TBL(1)=C
   READ A$: PRINT A$: REM  THE FIRST NOTE IS ALWAYS THE SAME

   FOR I = 2 TO 12
      READ A$
      UHOH:
      PRINT A$;: INPUT " ",B$
      CNTS = VAL (B$)
      IF CNTS > 1200 OR CNTS < 0 THEN GOTO UHOH
      TBL(I) = 2 ^ (CNTS / 1200) * C
   NEXT I

   INPUT "Frequency for A [usually 440]: ", NewA
   INPUT "Name of tuning / temperament: ", TUNING$
   CLS

   LPRINT TUNING$

   REM SET FREQUENCIES TO THE DESIRED A
   REM  "A" IS THE TENTH NOTE OF THE CHROMATIC SCALE
   PresA= TBL(10)
   FOR I = 1 TO 12
      TBL(I)= NewA * TBL(I) / PresA
      LPRINT TBL(I)
   NEXT I

DATA "C      =0","C#(Db)=","D      =","D#(Eb)="
DATA "E      =","F      =","F#(Gb)="
DATA "G      =","G#(Ab)=","A      ="
DATA "A#(Bb)=","B      ="
```

I have also included all flat and sharp values for mean temperament. To calculate these frequency values on a Macintosh which can be included in SOUND statements in BASIC, I used the program in Listing 1. Frequencies an octave above or an octave below are obtained by multiplying or dividing by 2.

When calculating frequencies of the historical temperaments, which were almost always based in the modern key of C, start with an arbitrary C frequency and correct for A = 440 (or A = 415) after the frequencies have been calculated. The Wavemaker section of "Turbo Traks" will do this for you. For the Mac, use the following conversion formula, implemented in the Macintosh program in Listing 1:

NewA = New frequency for middle A (415, 440, or whatever)
PresA = Present frequency for middle A
Ratio = NewA / PresA

Multiply each note of the scale by the value of "Ratio" to obtain the corrected frequency values. The Applesoft program in Listing 2 will create disk files which can be loaded by Soundchaser's "Turbo Traks" to change the system temperament in seconds.

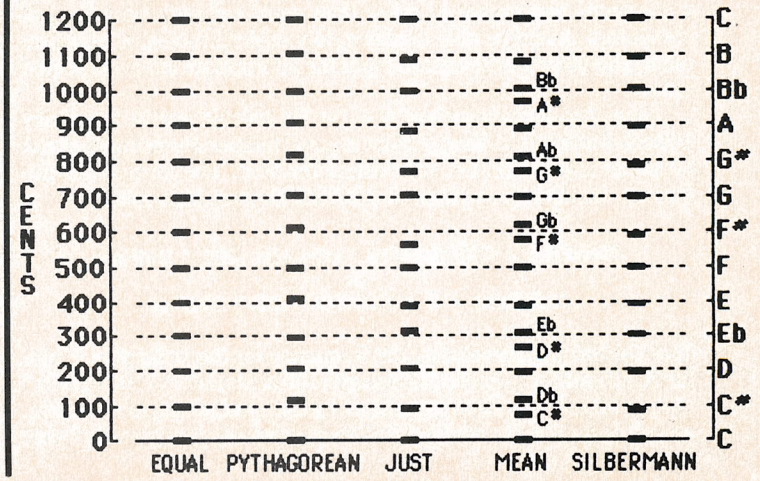
For comparison purposes, I have also prepared a graph showing interval differences, expressed in cent intervals, for different tuning systems. Created using Microsoft BASIC, it was sent to the Clipboard, enhanced with MacPaint, and it appears as Figure 1.

A good source for learning more about the historical tunings and temperaments is *Tuning and Temperament* by J. Murray Barbour, published by Da Capo Press, New York. In addition to a scholarly dissertation on the history of tuning and temperament, the book contains extensive tuning tables calculated in cent intervals. Remember, when working with a computer, you don't have to limit yourself to having only twelve notes in the octave. Don't confine computer music to rules imposed by an eighty-eight key piano and centuries of compromises. At your fingertips you have the ability to play in normal equal temperament with quarter tones, or to experiment with the old and an infinite number of new ways of octave division.

Listing 2

```
100  REM TUNING PROGRAM FOR TURBO TRAKS
105  REM APPLESOFT BASIC
110  REM WILLIAM K. DOLEN
120  REM
130  DIM TBL(73):TBL(1)=1
135  TU = 22368:FACT = 2.05:C = 131:D$ = CHR$(4)
140  READ A$: PRINT A$: REM  THE FIRST NOTE IS ALWAYS THE SAME

150  FOR I = 2 TO 12
160  READ A$
170  PRINT A$;: INPUT " ";B$
180  CNTS = VAL (B$)
190  IF CNTS > 1200 OR CNTS < 0 THEN GOTO 170
200  TBL(I) = 2 ^ (CNTS / 1200)
210  NEXT I

220  REM **SET UP THE LOWER OCTAVE AND ITS MULTIPLES**
230  FOR I = 1 TO 12
240  TBL(I) = C * TBL(I) * FACT
250  TBL(I + 12) = 2 * TBL(I)
260  TBL(I + 24) = 2 * TBL(I + 12)
270  TBL(I + 36) = 2 * TBL(I + 24)
280  TBL(I + 48) = 2 * TBL(I + 36)
290  TBL(I + 60) = 2 * TBL(I + 48)
300  NEXT I

310  REM **THE LAST NOTE**
320  TBL(73) = 64 * TBL(1)

330  REM **THE DOUBLE POKE**
340  FOR I = 0 TO 144 STEP 2
350  CNTS = TBL(I / 2 + 1)
360  HC = INT (CNTS / 256)
370  LC = CNTS - HC * 256
380  POKE TU + I,LC
390  POKE TU + I + 1, HC
400  NEXT I

410  INPUT "NAME OF TUNING FILE: ";NM$
420  NM$ = "TUNEX." + NM$
430  PRINT D$;"BSAVE ";NM$;",A22368,L146"
440  END

900  DATA "C   =0","C#(D-)=","D   =","D#(E-)="
910  DATA "E   =","F   =","F#(G-)="
920  DATA "G   =","G#(A-)=","A   ="
930  DATA "A#(B-)=","B   ="
```

FIGURE 1. RELATIVE INTERVALS FOR VARIOUS SYSTEMS OF TUNING AND TEMPERAMENT.



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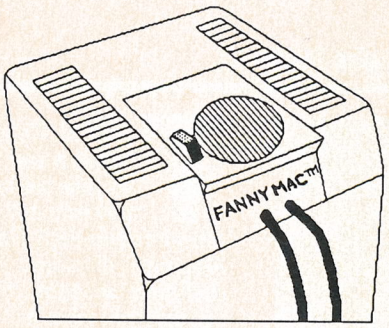

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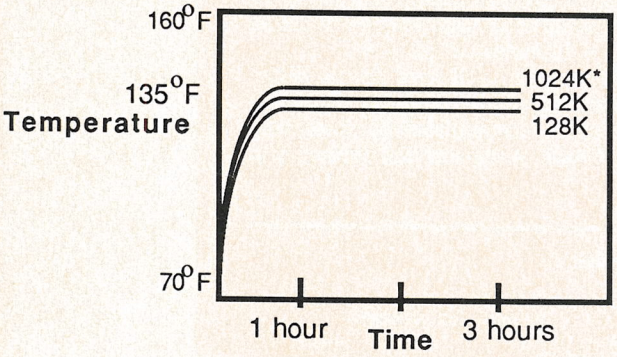

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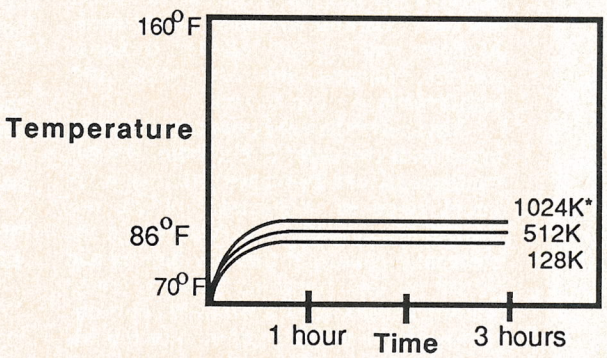

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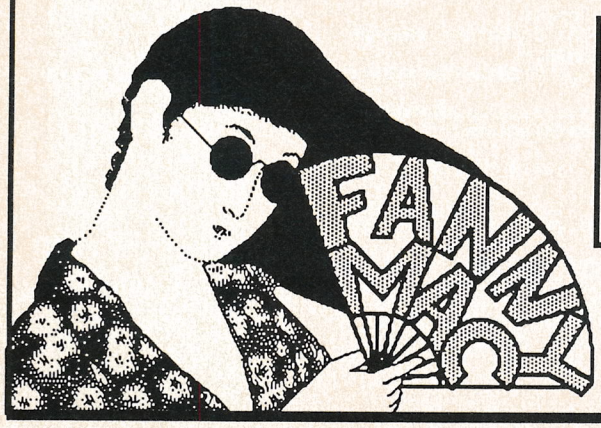

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Gerhald Hansel

TAXES! We all have to pay them, but how can we invest our money so that we receive more and the government less? You may have considered an IRA (Individual Retirement Account) or some other form of tax sheltered account, but have put it off because you were not sure that it would be beneficial. This program, TAX SHELTER BENEFITS, may help you decide.

TAX SHELTER BENEFITS allows you to compare the income you would receive from funds which have been placed in a tax sheltered account with those placed in an account in which the interest would be taxed each year. You will not always receive more money in a tax sheltered account than in a taxed account.

This program allows you to see the total income received using different conditions such as the initial deposit, the amount of yearly deposit, the number of years of deposit, the interest rates on savings, the tax rate at present, the tax rate in the future, and the withdrawal amounts at retirement. It allows you to enter different deposits, service charges, interest rates, and withdrawals for each account.

Tax shelters should be discussed with an investment counselor to determine the advantages and disadvantages of the many different types of investments. There are many fine points of the tax laws (which are constantly changing) that are beyond the scope of this program such as early withdrawal penalties and excess contribution penalties which could reduce the advantages of tax sheltered accounts.

Enter the Program

Type in the program as shown in the listing. Compare your program with the listing to make sure it is exactly the same.

When you run the program, it will set up the Apple for a 40 character line (line 1560) and then display the copyright. The program will then ask you to input your present tax rate. An example of how the data should be entered will be shown in the prompt statement. Be sure to type return after you have typed in the numbers. You will then input information, one item at a time, until you have given the computer your present tax rate, the future tax rate, the initial deposit, the yearly deposit, the interest rate, the number of years deposits will be made, your age, the present year, the percent service charge, the minimum service charge, the amount you intend to withdraw each year, and whether you want to use the printer.

The Apple will then print all the information as shown in Figure 1 so that you can check it for errors. If you have made an error, you will have to RUN the program again and enter the data correctly.

What Happens to Your Money?

The Apple will then print a year by year printout of what is happening to your money in the two accounts as shown in Figure 2. The last thing printed is a total of the income after taxes received from the two accounts. This printout is usually very long and it looks best on a printer. If you do not have a printer, the same information will be displayed on the screen for each year. To go on to the next year, you will have to press return.

The screen printout is rounded to the nearest dollar so that it will fit on a 40 character line. If you are using an 80 character wide screen and want the cents in the printout, you can change line 110 to 14 spaces instead of 11. Change line 770 also so that SL = 11 instead of SL = 8.

This program will give you a better understanding of the amounts of money which can be accumulated by systematic saving. Now if we can just find the money to save.

LISTING

```
100  DIM A$(11):S$ = "
                    ": REM  17 SPACES
110 E$ = "                    ": REM  11 S
     PACES
120  GOSUB 130: GOSUB 340: GOSUB
     1560: GOTO 380
130  TEXT : HOME : VTAB 5
140  PRINT "**********************
     ********************": PRINT

150  PRINT "TAX SHELTER BENEFITS"

160  PRINT : PRINT
170  PRINT "(C) COPYRIGHT 1985 GE
     RHALD HANSEL"
180  PRINT "ALL RIGHTS RESERVED":
      PRINT
190  PRINT "**********************
     ********************"
200  RETURN
210 T =  INT (100 * T + .5) / 100

220  IF A$ <  > "Y" THEN T =  INT
     (T + .5):T$ =  STR$ (T): GOTO
     300
230 T$ =  STR$ (T): IF T < .01 THEN
     T$ = ".00": GOTO 300
240 L =  LEN (T$)
250  IF L = 2 AND  LEFT$ (T$,1) <
      > "." AND  RIGHT$ (T$,1) <
      > "." THEN 290
```

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```
260  IF  MID$ (T$,L - 2,1) = "." THEN
     300
270  IF  MID$ (T$,L - 1,1) = "." THEN
     T$ = T$ + "0": GOTO 300
280  IF  MID$ (T$,L,1) = "." THEN
     T$ = T$ + "00": GOTO 300
290 T$ = T$ + ".00": GOTO 300
300 L =  LEN (T$)
310  IF L < SL THEN T$ = " " + T$
     : GOTO 300
320 T$ = T$ + "  "
330  RETURN
340  PRINT : PRINT "PRESS <RETURN
     > TO CONTINUE.";: INPUT X$
350  TEXT : HOME
360  IF A$ <  > "Y" AND F <  > 0 THEN
      PRINT A$(5);PS$;PT$: REM
       TOTALS
370  RETURN
380  PRINT "YOUR PRESENT TAX RATE
      ": PRINT
390  INPUT "30% IS ENTERED AS 30
     ";RP:RP = RP / 100: PRINT
400  PRINT "YOUR TAX RATE AT RETI
     REMENT "
410  INPUT "30% AS 30 ";RR:RR = R
     R / 100: HOME
420  PRINT "ENTER THE AMOUNTS FOR
      THE FOLLOWING:": PRINT
430  PRINT "ENTER THE INITIAL AMO
     UNT OF PRINCIPLE": PRINT
440  PRINT "$9,000 IS ENTERED AS
     9000 ": PRINT
450  INPUT "FOR THE TAX SHELTERED
      ACCOUNT ";PS: PRINT
460  INPUT "FOR THE TAXED ACCOUNT
     ";PT: HOME
470  PRINT "ENTER THE AMOUNT OF T
     HE DEPOSIT.": PRINT : PRINT
     "IT IS ASSUMED THAT THE DEPO
     SIT WILL BE": PRINT : PRINT
     "MADE ON JANUARY 1ST.": PRINT
     : PRINT "ENTER $2,000 AS 200
     0": PRINT
480  INPUT "DEPOSIT FOR TAX SELTE
     RED ACCOUNT ";DS: HOME
490 T = DS: GOSUB 210:DS$ = "$" +
     T$
500 TA = DS * RP:T = TA: GOSUB 21
     0:TA$ = " -" + T$
510 DT = DS - TA:T = DT: GOSUB 21
     0:DT$ = "$" + T$
520  PRINT "IF YOU PLACED YOUR DE
     POSIT IN": PRINT : PRINT "A
     TAXED ACCOUNT, YOUR INCOME W
     OULD BE": PRINT : PRINT "LAR
     GER AND THERE WOULD BE ADDIT
     IONAL": PRINT
530  PRINT "TAXES AND YOU WOULD H
     AVE LESS MONEY TO ": PRINT :
      PRINT "DEPOSIT.  THE DEPOSI
     T AFTER TAXES": PRINT : PRINT
     "WOULD BE: $"DT: PRINT
540  PRINT "ENTER THE DEPOSIT FOR
      THE TAXED ACCOUNT": PRINT :
      INPUT DT: PRINT :DT$ = "$" +
      STR$ (DT)
550  PRINT "ENTER INTEREST RATE":
      PRINT : PRINT "7.5% IS ENTE
     RED AS 7.5 ": PRINT
560  INPUT "FOR TAX SHELTERED ACC
     OUNT ";RS:RS = RS / 100: PRINT

570  INPUT "FOR TAXED ACCOUNT ";R
     T:RT = RT / 100: HOME
580  INPUT "NUMBER OF YEARS DEPOS
     ITS WILL BE MADE ";Y: PRINT

590  INPUT "YOUR PRESENT AGE ";AG
     : PRINT
600  INPUT "THE YEAR (SUCH AS 198
     5) ";YR: HOME
610  PRINT "SOME ACCOUNTS HAVE A
     SERVICE CHARGE.": PRINT
620  PRINT "THIS IS USUALLY A PER
     CENT OF THE": PRINT : PRINT
     "ACCOUNTS VALUE OR A MINIMUM
      CHARGE": PRINT : PRINT "WHI
     CH EVER IS GREATER.": PRINT

630  PRINT ".15% IS ENTERED AS .1
     5": PRINT
640  INPUT "PERCENT FOR THE SHELT
     ERED ACCOUNT ";CS:CS = CS /
     100: PRINT
650  INPUT "PERCENT FOR THE TAXED
      ACCOUNT ";CT:CT = CT / 100:
      PRINT
660  PRINT "$35.50 IS ENTERED  35
     .50": PRINT
670  INPUT "MINIMUM CHARGE FOR TA
     X SHELTERED ";MS: PRINT
680  INPUT "MINIMUM CHARGE FOR TA
     XED ACCOUNT ";MT: HOME
690  PRINT "YEARLY AMOUNT YOU WAN
     T TO WITHDRAW AT": PRINT
700  PRINT "RETIREMENT?  ENTER $5
     ,000 AS 5000 ": PRINT
710  INPUT "FROM TAX SHELTERED AC
     COUNT ";WS: PRINT
720 WT =  INT (WS - RR * WS + .5)

730  PRINT "THE WITHDRAWAL FROM T
     HE TAX SHELTERED": PRINT : PRINT
     "ACCOUNT WILL NOW BE TAXED A
     S INCOME.": PRINT
740  PRINT "A WITHDRAWAL FROM THE
      TAXED ACCOUNT OF": PRINT : PRINT
     "$"WT" WOULD BE EQUAL TO THE
      WITHDRAWAL": PRINT : PRINT
     "FROM THE TAX SHELTERED ACCO
     UNT.": PRINT
750  INPUT "FROM TAXED ACCOUNT ";
     WT: PRINT : HOME
760  INPUT "DO YOU WANT TO USE TH
     E PRINTER Y/N ";A$:A$ =  LEFT$
     (A$,1)
770 SL = 8: IF A$ = "Y" THEN SL =
     11
780  IF A$ = "Y" THEN E$ = "
                ": REM     14 SPACES

790  IF A$ = "Y" THEN  PRINT  CHR$
     (4);"PR#1": PRINT  CHR$ (9);
     "80N"
800  IF A$ = "Y" THEN  GOSUB 140
810  PRINT : PRINT
820  PRINT "PRESENT TAX RATE IS "
     100 * RP"%.": PRINT
830  PRINT "TAX RATE AT RETIREMEN
     T IS "100 * RR"%.": PRINT
840  PRINT "INITIAL DEPOSIT IS:":
      PRINT A$(10);"$"PS: PRINT A
     $(11);"$"PT: PRINT
850  PRINT "AMOUNT OF YEARLY DEPO
     SIT IS:": PRINT "TAX SHELTER
     ED",DS$: PRINT "TAXED DEPOSI
     T",DT$: PRINT
860  IF A$ <  > "Y" THEN  GOSUB 3
     40
870  PRINT "INTEREST RATE IS:": PRINT
     A$(10);RS * 100"%": PRINT A$
     (11);RT * 100"%": PRINT
880  PRINT "DEPOSITS WILL BE MADE
      FOR "Y" YEARS": PRINT
890  PRINT "YEARLY RETIREMENT WIT
     HDRAWAL IS:": PRINT A$(10);"
     $"WS: PRINT A$(11);"$"WT: PRINT

900  PRINT "YEARLY SERVICE CHARGE
      PERCENT IS:": PRINT A$(10);
     CS * 100"%": PRINT A$(11);CT
      * 100"%": PRINT
910  PRINT "YEARLY SERVICE CHARGE
      MINIMUM IS:": PRINT A$(10);
     "$"MS: PRINT A$(11);"$"MT: PRINT

920  IF A$ <  > "Y" THEN  GOSUB 3
     40
930  PRINT S$;"SHELTERED";"   TAX
     ED"
940  PRINT S$;" SAVINGS ";"  SAVI
     NGS"
950 T = PS: GOSUB 210:PS$ = "$" +
     T$
960 T = PT: GOSUB 210:PT$ = "$" +
     T$
970  GOSUB 1230
980  GOTO 1260
990  PRINT "YOUR AGE IS "AG,:AG =
     AG + 1
1000  PRINT "   THE YEAR IS "YR:Y
     R = YR + 1
1010  RETURN
1020 T = DS: GOSUB 210:DS$ = "+" +
     T$
1030 T = DT: GOSUB 210:DT$ = "+" +
     T$
1040  PRINT A$(1);DS$;DT$: REM  D
     EPOSIT
1050 IS = (PS + DS) * RS:T = IS: GOSUB
     210:IS$ = "+" + T$
1060 IT = (PT + DT) * RT:T = IT: GOSUB
     210:IT$ = "+" + T$
1070  PRINT A$(2);IS$;IT$: REM  I
     NTEREST
1080 SS = (PS + DS + IS) * CS: IF
     SS < MS THEN SS = MS
1090 ST = (PT + DT + IT) * CT: IF
     ST < MT THEN ST = MT
1100  IF PS < .01 THEN SS = 0
1110  IF PT < .01 THEN ST = 0
1120 T = SS: GOSUB 210:SS$ = "-" +
     T$
1130 T = ST: GOSUB 210:ST$ = "-" +
     T$
1140  PRINT A$(3);SS$;ST$: REM  S
     ERVICE CHARGE
1150 TT = IT * RP:T = TT: GOSUB 2
     10:TT$ = "-" + T$
1160  PRINT A$(4);E$;TT$: REM   T
     AX ON INTEREST
1170 PS = PS + DS + IS - SS
1180 PT = PT + DT + IT - ST - TT:
      RETURN
1190  PRINT S$;"------------";"--
     ---------"
1200 T = PS: GOSUB 210:PS$ = "$" +
     T$
1210 T = ET: GOSUB 210:ET$ = "$" +
     T$
1220 T = PT: GOSUB 210:PT$ = "$" +
     T$
1230  PRINT A$(5);PS$;PT$:F = 1: REM
      TOTALS
1240  IF A$ <  > "Y" THEN  GOSUB
     340
1250  PRINT : RETURN
1260  FOR M = 1 TO Y
1270  GOSUB 990: GOSUB 1020: GOSUB
     1190: PRINT
1280  NEXT M
1290  PRINT : PRINT "DEPOSITS ARE
     REDUCED TO ZERO.":DS = 0:DT
     = 0
1300  PRINT :PR = RR
1310  GOSUB 990
1320  GOSUB 1050
1330  IF WS >  = PS THEN WS = PS
1340 T = WS: GOSUB 210:WS$ = "-" +
     T$
1350  IF WT >  = PT THEN WT = PT
1360 T = WT: GOSUB 210:WT$ = "-" +
     T$
1370 YS = YS + WS:YT = YT + WT
1380  PRINT A$(6);WS$;WT$: REM  W
     ITHDRAWAL
1390 PS = PS - WS:PT = PT - WT
1400  GOSUB 1190
1410  IF PS > .01 OR PT > .01 THEN
     1310
1420 T = YS: GOSUB 210:YS$ = "$" +
     T$
1430 T = YT: GOSUB 210:YT$ = "$" +
     T$
1440 TW = YS * RR:T = TW: GOSUB 2
     10:TW$ = "-" + T$
1450 ZT = 0:T = ZT: GOSUB 210:ZT$
      = "-" + T$
1460  PRINT A$(7);YS$;YT$: REM
     TOTAL WITHDRAWAL
1470  PRINT A$(8);TW$;ZT$: REM
     TAX ON WITHDRAWAL
1480 TI = YS - TW:T = TI: GOSUB 2
     10:TI$ = "$" + T$
1490  PRINT A$(9);TI$;YT$: PRINT
     : PRINT : REM      TOTAL INCO
     ME
1500  PRINT  CHR$ (4);"PR#0": END

1510  PRINT "WHEN ENTERING NUMBER
     S, THE COMMA IS NOT": PRINT

1520  PRINT "USED.   $6,000 IS EN
     TERED AS 6000": PRINT
1530  PRINT "$650.50 IS ENTERED A
     S 650.50": PRINT
1540  INPUT "PRESS <RETURN> TO CO
     NTINUE";A$
1550  PRINT  CHR$ (4);"PR#0": RUN

1560  POKE 33,40
1570  FOR ZZ = 1 TO 11
1580  READ A$(ZZ)
1590 A$(ZZ) = A$(ZZ) + S$
1600 A$(ZZ) =  LEFT$ (A$(ZZ),17)
1610  NEXT : RETURN
1620  DATA     DEPOSIT,INTEREST,S
     ERVICE CHARGE,TAX ON INTERES
     T,TOTAL IN ACCOUNT, WITHDRAW
     AL,TOTAL WITHDRAWAL,TAX ON W
     ITHDRAWAL,TOTAL INCOME,TAX S
     HELTERED,TAXED
1630  REM  TAX SHELTER BENEFITS
```

Figure 1

```
**************************************

TAX SHELTER BENEFITS

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**************************************

PRESENT TAX RATE IS 25%.

TAX RATE AT RETIREMENT IS 35%.

INITIAL DEPOSIT IS:
TAX SHELTERED     $3000
TAXED             $3000

AMOUNT OF YEARLY DEPOSIT IS:
TAX SHELTERED    $2000
TAXED DEPOSIT    $1500

INTEREST RATE IS:
TAX SHELTERED     9%
TAXED             9%

DEPOSITS WILL BE MADE FOR 2 YEARS

YEARLY RETIREMENT WITHDRAWAL IS:
TAX SHELTERED     $4000
TAXED             $2600

YEARLY SERVICE CHARGE PERCENT IS:
TAX SHELTERED     .15%
TAXED             0%

YEARLY SERVICE CHARGE MINIMUM IS:
TAX SHELTERED     $40
TAXED             $0
```

Figure 2

```
                    SHELTERED    TAXED
                     SAVINGS    SAVINGS
TOTAL IN ACCOUNT  $    3000.00  $    3000.00

YOUR AGE IS 61       THE YEAR IS 1985
DEPOSIT           +     2000.00  +     1500.00
INTEREST          +      450.00  +      405.00
SERVICE CHARGE    -       40.00  -        .00
TAX ON INTEREST                  -      101.25
                  ---------------------------
TOTAL IN ACCOUNT  $    5410.00  $    4803.75


YOUR AGE IS 62       THE YEAR IS 1986
DEPOSIT           +     2000.00  +     1500.00
INTEREST          +      666.90  +      567.34
SERVICE CHARGE    -       40.00  -        .00
TAX ON INTEREST                  -      141.83
                  ---------------------------
TOTAL IN ACCOUNT  $    8036.90  $    6729.25


DEPOSITS ARE REDUCED TO ZERO.

YOUR AGE IS 63       THE YEAR IS 1987
INTEREST          +      723.32  +      605.63
SERVICE CHARGE    -       40.00  -        .00
TAX ON INTEREST                  -      151.41
WITHDRAWAL        -     4000.00  -     2600.00
                  ---------------------------
TOTAL IN ACCOUNT  $    4720.22  $    4583.48

YOUR ASE IS 64       THE YEAR IS 1988
INTEREST          +      424.82  +      412.51
SERVICE CHARGE    -       40.00  -        .00
TAX ON INTEREST                  -      183.13
WITHDRAWAL        -     4000.00  -     2600.00
                  ---------------------------
TOTAL IN ACCOUNT  $    1105.04  $    2292.86

YOUR AGE IS 65       THE YEAR IS 1989
INTEREST          +       99.45  +      206.36
SERVICE CHARGE    -       40.00  -        .00
TAX ON INTEREST                  -       51.59
WITHDRAWAL        -     1164.49  -     2147.63
                  ---------------------------
TOTAL IN ACCOUNT  $        .00  $        .00

TOTAL WITHDRAWAL  $    9164.49  $    7647.63
TAX ON WITHDRAWAL -    3207.57  -        .00
TOTAL INCOME      $    5956.92  $    7647.63
```


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Circle 11 on Reader Service Card

ProDOS Undelete

Wes Felty

IN DOS 3.3 it was a trivial problem to undelete a disk file. Several copy and utility programs provided options for this purpose and it could be accomplished manually using a disk zap program. Similar disk utilities to undelete ProDOS files have *not* been showing up, and there is a good reason for it. Undeleting ProDOS files is anything but trivial. This article will cover the problems involved, a solution program, and a general subroutine and explanation on how to read blocks directly off the disk and write them directly back on. The "ProDOS.UNDELETE" program will not work 100% of the time, sometimes it just isn't possible to undelete a ProDOS file. If new data hasn't been saved to the disk, or if new data hasn't been saved to the blocks that your deleted file used, then ProDOS.UNDELETE will give you a very good chance of recovering your data in either automatic or manual mode. ProDOS.UNDELETE will work on any type of ProDOS file. Due to the additional complexities involved, however, ProDOS.UNDELETE will not work on files of more than 256 blocks.

Where ProDOS Stores Information on a Disk

Before, we tackle how to undelete ProDOS files, we need to understand a little of how ProDOS stores its information on a disk and exactly what it does to delete it. ProDOS stores a lot of information about each file in its disk directory on blocks 2-5, but we only need to understand a little of it to put together the program, ProDOS.UNDELETE.

To begin with, the first byte of each file's directory entry contains information telling the file's storage type and the number of characters in its name. These storage types include a sapling file (a file taking up only one disk block and having a code number of one), a seedling file (a file taking up between three and 256 blocks and having a code number of two), and a tree file (a file with more than 256 blocks in it and having a code number of three). This one, two, or three makes up the left digit of the storage type byte. The right digit tells the number of characters in the file's name. Since a hexadecimal digit can only go up to a size of 15, ProDOS file names have a maximum of 15 characters. If a file has been deleted, this first byte is changed to zero so ProDOS has no trouble recognizing deleted files in its directory.

The 19th and 20th bytes of each directory entry tell how many blocks make up the file. This makes it easy to determine if the file is a seedling, sapling, or tree type, even though ProDOS destroyed this information while deleting the file.

ProDOS puts a number in the directory's Volume header, in bytes 37 and 38, that tells how many undeleted files there are on the disk. From this information, it can stop searching the directory as soon as it finds the last active file.

In the 17th and 18th bytes of each directory entry, ProDOS lists the key block pointer. In a sapling file, that is the block number of where the file is actually stored. In a sapling file, the key block is the block that lists all of the other blocks that contain the file's information, very much like the track/sector list of DOS 3.3. And, in a tree file, the key block lists the other key blocks that each hold a listing of the blocks that actually contain the data.

Finally, on the beginning of ProDOS's sixth block is a disk bit map that marks each of ProDOS's 280 blocks as being either free to write to or in use. Each bit of each byte represents one block, so it only takes the first 35 bytes of block six to hold the bit map of a standard floppy disk.

How ProDOS Erases a File

What does ProDOS do to erase a file from the disk? Like DOS 3.3, it doesn't actually erase the data from the disk, just part of the path to it. For all types of files, ProDOS sets the type byte to zero, sets the number of active files to one less than it was in the disk volume header, and marks the disk bit map to free up each disk block of the file to be written on. Then it handles each file type a little differently. If a file is a sapling type file, ProDOS makes no changes to the key block, and the deleting process is finished. If a file is a seedling type, then ProDOS erases all of the block numbers except the very first one. This is what makes it so hard to undelete a ProDOS file. DOS 3.3 doesn't erase its Track/Sector lists so it is easy to find all of the deleted sectors. It just marks each of them as free to write over but leaves them intact on the disk. With ProDOS, we somehow have to find all of the blocks after the first one that contained data.

How ProDOS.UNDELETE Works

The first thing that ProDOS.UNDELETE has to do is find the names of

the deleted files and let you choose what files to undelete. That isn't too difficult. ProDOS.UNDELETE doesn't use the ProDOS catalog command at all. It just reads directly from the disk blocks 2-6 (lines 250, 390, and 90-150) to get the directory and disk map into a memory buffer, and then reads the buffer. It creates and protects this buffer by moving the Applesoft BASIC program up in memory from page 8 to page 24 (line 5), and then loads the blocks into pages 8-24. With each block taking two pages of memory, the directory itself is loaded into page 8-15, the bit map is loaded at page 16-17, a buffer is set aside at 18-19 to read the key block into, and another buffer is set aside at pages 20-21 to read in files and check their validity. A two-page buffer zone is left between the critical date to inspect and the start of program at page 24.

Then, to find the deleted files, ProDOS.UNDELETE just looks for files whose type byte is zero (line 460) but whose name doesn't begin with a zero as empty files do (line 470). It then reads the file name by cycling through each character until it finds a zero or does 15 characters (line 530). It might come up with some strange names here because, in earlier versions of ProDOS, previously deleted file names were never removed. New file names were just written over the old ones, and the number of characters in the name was stored in the first byte of the directory field. If the previous name had been longer than a later one, then they both would show up combined in the ProDOS.UNDELETE file name. For example, if a file by the name of "CAT.AND.MOUSE" were deleted and another file with the name of "RAT" were stored in the same spot, then ProDOS.UNDELETE would come up with a file name of "RAT.AND.MOUSE." Since the "length of name" nibble was destroyed by the deleting process, there is no way to be sure of how many characters belonged to the last name and how many belonged to former names. ProDOS.UNDELETE also picks up the important data for each file and stores it in arrays (lines 480-530).

After displaying the names of the deleted files and getting your selection for the file to undelete (lines 550-660), ProDOS.UNDELETE determines if the file is a sapling or seedling type (line 690). For a *sapling* file, it checks to see if the key block is marked as free or in use by the bit map (GOSUB 930). If the sapling's key block is being used, then a new file has been written over the file and it is impossible to recover. ProDOS.UNDELETE then aborts the undeletion process and erases the file name from the directory. If the key block is free, then it is loaded into a buffer and checked for validity if you choose to monitor the file recovery. If you accept the file, then its key block is marked as used in the disk bit map, the file type and "number of characters in the name" byte is restored in the directory, the number of active files in the volume heading is increased by one, and finally, blocks 2-6 are written back to the disk with the undeletions in place.

For a *seedling* file, the process is similar except that more than one data block must be found and restored in the disk bit map. How does ProDOS.UNDELETE find the correct blocks? Well, fortunately, ProDOS stores data on adjacent blocks in ascending order whenever it can. ProDOS.UNDELETE finds the block number of the first block of the data from what is left of the key block and then looks through the disk bit map for the next higher block that is marked as free. When ProDOS.UNDELETE finally finds the correct number of free blocks, it finishes up the same way that the sapling file did.

What Could Go Wrong and How to Fix It

If a disk has had little deleting of other files to it after the one that you want to undelete, then ProDOS.UNDELETE should have little or no problem doing its job. But what, for example, would happen if you had had 10 single block files stored on a disk, had deleted every other one, had stored and then deleted a long file, and now wanted to undelete the long file? That

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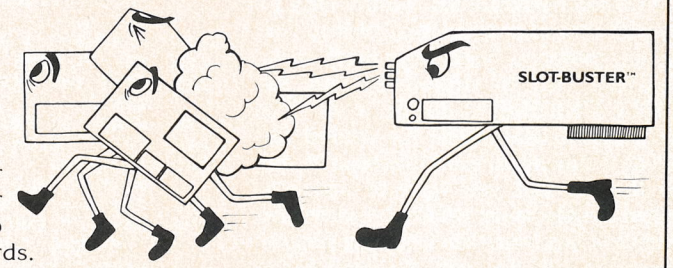

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would offer no problem at all. ProDOS. UNDELETE would find the blocks that weren't the correct ones being marked as used in the bit map, and it would go on to find the correct deleted blocks. But, what if all of these files were deleted? ProDOS. UNDELETE would be finding every other block correctly and every other block incorrectly, since they are all marked as unused. This is why programmers aren't rushing out writing ProDOS undelete programs. There is no way for a program to tell the correct blocks from the incorrect blocks if they are inter-mixed. This is why any file that has been undeleted should be checked to see that it is o.k. If it isn't, then it can be deleted and then undeleted again using the manual mode.

How can we get around this problem of inter-mixed deleted files? By using the best computer known to man, the one computer that can make decisions. . . our own brains. ProDOS.UNDELETE allows us to scan the blocks as they are recovered and accept or reject each one as it comes up. Checking out the type of program, line numbers at the end of one page and beginning of another, and the content of the files should make it fairly obvious if the blocks go together. I strongly suggest always using this manual mode of operation described in the next section.

How To Use ProDOS.UNDELETE

ProDOS.UNDELETE is fairly easy to use with control prompts in all places. Just run the program, insert your work disk, pick the file to undelete, and let ProDOS.UNDELETE do the work. You can press CTRL-C while the deleted file catalog is running to abort it as soon as you see the file that you want to undelete. Unless the disk is known to have very little deleting of files on it, then I strongly suggest answering "Y" for yes to monitor the undeletion operation. Along with the list of titles of deleted files, the original menu of deleted files shows the number of blocks in each file and the type of file. This might tell you how hard it is going to be to recover data. The program itself will automatically determine if the file is Applesoft BASIC, Text, or machine language, and display it in the appropriate mode. If a file is probably a hi-res graphics screen, you will be told that and given the opportunity to display it on the screen after it is recovered. You may switch to any of the other display modes by pressing "A" for Applesoft, "T" for Text, or "M" for machine language. You may also press the "ESC" key to abort the manual mode of scanning and accepting or rejecting each block. If you press any other key, then the display of that page will be aborted and you will be asked if you wish to accept or reject that block. If you reject the first block, then the undeletion process is aborted since the first block is the key to finding all of the other blocks. This is how the program is finally able to deal with inter-mixed deleted files. When the machine language display goes by too quickly, you need to press CTRL-S to cause it to pause long enough to read it. Also, the machine language display will not stop instantly if you press the "A" or "T" key, but shift to the new mode as soon as it finishes, which is very quickly. The "M"

Basic Program Listing. . . ProDOS.UNDELETE

```
5  IF  PEEK (104) <  > 24 THEN  POKE 104,24: POKE 6144,0: POKE
     6145,0: POKE 6146,0: PRINT  CHR$ (4)"RUN PRODOS.UNDELETE"
10  REM
                        ERROR HANDLING ROUTINE

20  ONERR  GOTO 40
30  GOTO 170
40  IF  PEEK (222) = 255 THEN 610
50  PRINT "Error Number " PEEK (222)" occurred in line number " PEEK
     (218) + 256 *  PEEK (219): PRINT : PRINT "Press any key to
     continue": GET ZZ$: GOTO 230
60  PRINT  CHR$ (7) CHR$ (7): PRINT : PRINT "Error Number " PEEK
     (222)" occurred in line number " PEEK (218) + 256 *  PEEK (219):
     PRINT : PRINT "Undeleting ABORTED": END
70  GOTO 50
80  REM
                        READ A PRODOS BLOCK ROUTINE

90  ML = 739: POKE ML + 10,96: REM DRIVE 1
100  POKE ML + 3,CD: REM READ/WRITE COMMAND
110  POKE ML + 12,BF: REM BUFFER PAGE NUMBER
120 LO = BLOCK: IF BL > 255 THEN LO = BL - 255:HI = 1
130  POKE ML + 13,LO: POKE ML + 14,HI
140  CALL ML: REM READ OR WRITE BLOCK
150  RETURN
160  REM
                        INITIALIZATION

170  TEXT : HOME :RD = 128:WR = 129: REM READ/WRITE COMMANDS FOR
     BLOCK READ SUBROUTINE
180  REM
                    PRODOS BLOCK READ/WRITE ROUTINE

190  ML = 739: FOR ZZ = 0 TO 25: READ Z: POKE ML + ZZ,Z: NEXT : DATA
     32,0,191,
     128,236,2,208,8,96,3,224,0,8,16,0,96,32,218,253,32,58,255,32,190,
     253,96
200  DIM N$(51),DT(51,3),TYPE$(51),CMD$(106)
210  TEXT : HOME : PRINT "            ProDOS UNDELETE": POKE 34,5
220  VTAB 10: PRINT "Do you wish to monitor the data recovery";: GET
     BR$
230  VTAB 13: PRINT : PRINT "Place the ProDOS disk in drive # 1 and"
240  PRINT "press any key to continue!": GET ZZ$
250 B1 = 8:B2 = 18:B3 = 20:BUFFER = 256 * B1:BK = 256 * 18:BT = 256 *
     20:X = 59:D1 = 96:HI = 0:SP = 1
260  FOR A = 0 TO 106: READ CMD$(A): NEXT
270  DATA  " END "," FOR "," NEXT "," DATA "," INPUT "," DEL "," DIM
     "," READ "," GR "," TEXT "," PR# "," IN# "," CALL "," PLOT ","
     HLIN "," VLIN "
280  DATA  " HGR2 "," HGR "," HCOLOR "," HPLOT "," DRAW "," XDRAW ","
     HTAB "," HOME "," ROT= "," SCALE= "," SHLOAD "," TRACE ","
     NOTRACE "," NORMAL "," INVERSE "," FLASH "
290  DATA  " COLOR= "," POP "," VTAB "," HIMEM: "," LOMEM "," ONERR
     "," RESUME "," RECALL "," STORE "," SPEED= "," LET "," GOTO ","
     RUN "," IF "," RESTORE "," & "
300  DATA  " GOSUB "," RETURN "," REM "," STOP "," ON "," WAIT ","
     LOAD "," SAVE "," DEF "," POKE "," PRINT "," CONT "," LIST ","
     CLEAR "," GET "," NEW "
310  DATA  " TAB "," TO "," FN "," SPC("," THEN "," AT "," NOT ","
     STEP "," + "," - "," * "," / "," ^ "," AND "," OR "," > "
320  DATA  " = "," < "," SGN "," INT "," ABS "," USR "," FRE","
     SCRN("," PDL","," POS","," SQR","," RND","," LOG","," EXP","," COS","," SIN"
330  DATA  " TAN","," ATN","," PEEK","," LEN","," STR$","," VAL","," ASC","
     CHR$","," LEFT$","," RIGHT$","," MID$"
340  POKE 765,104: POKE 766,104: POKE 767,96: GOTO 390: REM MACHINE
     LANGUAGE DISASSEMBLY RETURN AT $2FD
350  REM
                    MACHINE LANGUAGE DISASSEMBLER CALLER

360 DA$ = "1400LLLLLLLLLLLLLLLL 2FDG": REM  DISASSEMBLE 16 "L"'S AND
     RETURN
370  FOR A = 1 TO  LEN (DA$): POKE 511 + A, ASC ( MID$ (DA$,A,1)) +
     128: NEXT : CALL  - 144
380  RETURN
390 BF = B1:CD = RD: FOR BL = 2 TO 6: GOSUB 90:BF = BF + 2: NEXT :
     REM READ CATALOG & BIT MAP
400  HOME :NL =  PEEK (BU + 4) - 240: FOR ZZ = 1 TO NL:VN$ = VN$ +
     CHR$ ( PEEK (BU + 4 + ZZ)): NEXT : PRINT "Name of Volume ==>
     "VN$: PRINT
```

Continued

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display will also display some extra code at the end of each page. Since the outline to use the monitor disassembler from a BASIC program can't tell when a certain memory location is reached, ProDOS. UNDELETE automaticlly disassembles 16 pages of instructions. The actual page of data is from $1400 to $15FF, so ignore any code beyond $15FF.

If any CTRL characters are embedded in an Applesoft program, they will be displayed as inverse characters. With AppleWorks files, the first page or two will probably look like garbage. This will be its own internal pointers and operating system. For AppleWorks word processor files, type AWP, you will see a series of horizontal and vertical lines and a blank screen for a time. During the display of text, you will see odd numbers and symbols about every other line. These are just the AppleWork's length of next line codes that it uses to format the text. Ignore them.

For safety sake, it would be a very good idea to use a "copy whole disk" program like COPYA to copy the work disk *before* trying to undelete any programs. Any program like ProDOS.UNDELETE that writes directly to a disk can really destroy data fast if you have made any errors in entering the program. Always check out the undeleted file to be sure that no unrelated files got mixed in. If there is any problem, then just delete the file and everything will be back to where it was before using the ProDOS.UNDELETE. If you ever come up with "I/O" errors or "file damaged" error messages, then use the ProDOS filer copy files program using the "?" wildcard character.

Reading Directly From and Directly to the Disk in ProDOS

It is much easier to read or write directly from or to the disk in ProDOS than in DOS 3.3. This is all that has to be done:

1. Call the Machine Language Interface (MLI),
2. tell the MLI the command number ($80 for read and $81 for write),
3. tell the MLI where the parameter list is located, and
4. put the parameters in a list for the MLI to read.

For a read or write operation, there are just three parameters: the device number giving the slot and disk drive number, the address of the buffer to read into or write from (it must be at least 512 bytes long), and the block number to read from or write to. See the "disassembled" listing below. It isn't truly disassembled, since the listing is arranged to better show the parameters which the disassembler improperly tries to interpret as machine language commands. That is why some of the lines have no middle column entries.

Notice that while a MLI calling routine is

```
410 NF =  PEEK (BU + 37) + 256 *  PEEK (BU + 38): PRINT NF" Undeleted
    files were found": PRINT : PRINT : PRINT "              Deleted
    Files"
420 PRINT : PRINT "    File Name";: HTAB 21: PRINT "TYPE";: HTAB 26:
    PRINT "KEY";: HTAB 31: PRINT "No of B1's"
430 REM
                              READ FILE NAMES

440 A = 1:MAX = 0:PP = 43:SP = 1: FOR Z = 1 TO 51:N$(Z) = ""
450  IF PP >  = 512 * SP - 8 THEN PP = PP + 5:SP = SP + 1
460 ST =  PEEK (BU + PP): IF ST <  > 0 THEN 570: REM    STORAGE TYPE
    & NO. OF CHAR'S IN NAME
470  IF  PEEK (BU + PP + 1) = 0 THEN 570: REM    NO FILE NAME
480 DT(A,1) =  PEEK (BU + PP + 17) + 256 *  PEEK (BU + PP + 18): REM
    KEY BLOCK NUMBER
490 DT(A,2) =  PEEK (BU + PP + 19) + 256 *  PEEK (BU + PP + 20): IF
    DT(A,2) > 256 THEN  PRINT  CHR$ (7)"Tree files can't be
    undeleted": END : REM NUMBER OF BLOCKS USED & ABORT IF TREE FILE
500 DT(A,3) = PP: REM    POINTER TO START OF DELETED FILE IN CATALOG
510 DT =  PEEK (BU + PP + 16): GOSUB 1310: REM  GET FILE TYPE
520 N = 1
530  IF N < 16 AND  PEEK (BU + PP + N) <  > 0 THEN N$(A) = N$(A) +
    CHR$ ( PEEK (BU + PP + N)):N = N + 1: GOTO 530
540 NB = Z: IF NB > 26 THEN NB = NB - 26
550  PRINT "[" CHR$ (A + 64)"]";
560  HTAB 5: PRINT N$(A);: HTAB 21: PRINT TYPE$(A);: HTAB 26: PRINT
    DT(A,1);: HTAB 31: PRINT DT(A,2):A = A + 1:MAX = A
570 PP = PP + 39
580  NEXT
590  POKE 34, PEEK (37)
600  IF MAX = 0 THEN  PRINT : PRINT "     NO UNDELETED FILES WERE
    FOUND!": PRINT : PRINT "Insert another disk and press any key ":
    GET ZZ$: GOTO 210
610  PRINT : REM
                           SELECT FILE TO UNDELETE

620  PRINT "Select the file to undelete ";: GET SEL$:SEL =  ASC
    (SEL$) - 64: PRINT SEL$: IF SEL > MAX - 1 THEN  HOME : PRINT
    CHR$ (7): GOTO 620
630  POKE 34,5
640 MODE$ = "T": IF TYPE$(SEL ) = "BAS" THEN MODE$ = "A"
650  IF TYPE$(SEL ) = "BIN" THEN MODE$ = "M": IF DT(SEL,2) = 17 THEN
    HR = 1
660  IF TYPE$(SEL ) = "SYS" THEN MODE$ = "M"
670  REM
                              MAIN PROGRAM

680  POKE 216,0: ONERR  GOTO 60
690  IF DT(SEL,2) <  > 1 THEN 740
700 B = DT(SEL,1): REM SET NUMBER OF BLOCK TO WORK WITH
710  GOSUB 930
720  IF BR$ = "Y" THEN  GOSUB 1050: IF AR$ = "R" THEN  PRINT  CHR$
    (7): PRINT "Undeleting was rejected. Program abortedwith no
    changes made!": END
730  POKE 256 * 16 + BYTE,NW: GOSUB 990: GOTO 1420
740 BL = DT(SEL,1):BF = B2:CD = RD: GOSUB 90:B =  PEEK (BK): REM READ
    KEY BLOCK
750 CSUM = 0: FOR A = 2 TO 250:CSUM = CSUM +  PEEK (BK + A): IF CSUM
    THEN 770
760  GOSUB 930: IF  NOT BB THEN  POKE 256 * 16 + BYTE,NW: GOTO 780
770  PRINT  CHR$ (7): PRINT : PRINT N$(SEL)" is damaged": PRINT :
    PRINT "It is not possible to UNDELETE ": POKE BU + DT(SEL,3) +
    1,0:CD = WR:BF = 8: FOR BL = 2 TO 5: GOSUB 90:BF = BF + 2: NEXT
    : END
780  IF  NOT HR AND BR$ = "Y" THEN  GOSUB 1050
790  IF HR THEN  HOME : PRINT  CHR$ (7)N$(SEL)" is probably a HI-RES
    file.": PRINT "If so, its display here will be garbage.": PRINT
    "Press any key to continue ": GET Z$: IF BR$ = "Y" THEN  GOSUB
    1050
795  IF AR$ = "R" THEN  PRINT  CHR$ (7): PRINT "Undeleting is aborted
    due to first block being rejected!": END
800 B = B + 1:NX = 2:ERR = 0:EFLAG = 0: REM EXTRA JUMP FROM 1ST TO
    2ND KEY BLOCK NO.
810 B = B + 1: IF B = 280 THEN B = 7:EFLAG = 1
820  IF B = DT(SEL,1) THEN ERR = ERR + 1: GOTO 810
830  GOSUB 930: IF BB THEN ER = ER + 1: GOTO 810
840  IF BR$ = "Y" THEN  GOSUB 1050: IF AR$ = "R" THEN ER = ER + 1:
    GOTO 810
850  POKE BK + NX - 1,B: POKE 256 * 16 + BYTE,NW: REM PUT BLOCK
    NUMBER BACK IN KEY BLOCK & MARK BIT MAP
860 NX = NX + 1: IF NX < DT(SEL,2) THEN 810
870 B = DT(SEL,1): GOSUB 930: IF  NOT BB THEN  POKE 256 * 16 +
    BYTE,NW
880  IF ERR THEN  PRINT  CHR$ (7): PRINT "There were "ER" block jumps
    in": PRINT " reconstructing the Key block": PRINT : PRINT "Press
    'A' to abort the undeletion or anyother key to continue. ": GET
    ZZ$: IF ZZ$ = "A" THEN  END
890  IF EFLAG THEN  PRINT  CHR$ (7): PRINT "Some blocks were out of
    order": PRINT : PRINT "Press 'A' to abort the undeletion or
    anyother key to continue. ": GET ZZ$: IF ZZ$ = "A" THEN  END
```

```
900 BL = DT(SEL,1):BF = B2:CD = WR: GOSUB 90: GOSUB 990: GOTO 1420:
    REM DONE
910  END
920  REM
                    CHECK BIT MAP TO SEE IF BLOCK IS USED

930 BYTE =  INT (B / 8):BIT = 7 - (B - 8 * BYTE):BO = 2 ^ BIT: REM
    ASL
940 OLD =  PEEK (256 * 16 + BYTE):TST =  INT (OLD / 2 ^ BIT):BB = 0:
    IF  INT (TST / 2) = TST / 2 THEN BB = 1: REM BB=1 MEANS BLOCK IS
    IN USE
950  IF DT(SEL,2) = 1 AND BB THEN  PRINT  CHR$ (7): PRINT : PRINT
    "BLOCK NUMBER "B" IS NO LONGER FREE": PRINT : PRINT "It is not
    possible to UNDELETE "N$(SEL): POKE BU + DT(SEL,3) + 1,0:CD =
    WR:BF = 8: FOR BL = 2 TO 5: GOSUB 90:BF = BF + 2: NEXT : END
960 NW = OLD - BO
970  RETURN
980  REM
                          RESTORE CATALOG

990 ST = 16 * (1 + (DT(SEL,2) > 1)) +  LEN (N$(SEL)): POKE BU +
    DT(SEL,3),ST
1000  IF  PEEK (BU + 37) = 255 THEN  POKE BU + 37,0: POKE BU + 38,
    PEEK (BU + 38) + 1: GOTO 1020
1010  POKE BU + 37, PEEK (BU + 37) + 1
1020 CD = WR:BF = 8: FOR BL = 2 TO 6: GOSUB      = BF + 2: NEXT
1030  RETURN
1040  REM
                       APPLESOFT DECODER

1050 BF = B3:BL = B:CD = RD: GOSUB 90:AR$ = "": PRINT
1060 D1$ =  RIGHT$ ("00" +  STR$ (NX + 1),3):D2$ =  RIGHT$ ("00" +
    STR$ (DT(SEL,2)),3)
1070  TEXT : HOME : HTAB 12: PRINT "ProDOS UNDELETE";: HTAB 31: PRINT
    D1$"/"D2$: PRINT : PRINT "MODE:";: IF MODE$ = "A" THEN  INVERSE
1080  HTAB 8: PRINT "APPLESOFT";: NORMAL : IF MODE$ = "T" THEN
    INVERSE
1090  HTAB 19: PRINT "TEXT";: NORMAL : IF MODE$ = "M" THEN  INVERSE
1100  HTAB 25: PRINT "MACHINE LANGUAGE": NORMAL : POKE 34,4
1110  HOME : IF MODE$ <  > "M" THEN 1140
1120  GOSUB 360: IF  PEEK ( - 16384) > 128 THEN 1180
1130 OFF = 512: GOTO 1270
1140 OFF = 2: IF MODE$ <  > "A" THEN OFF = 0: GOTO 1160
1145 IF NX > 1 AND PEEK (BT + OFF - 1) <  > 0 THEN OFF = OFF - 2:
    GOTO 1160
1150 LN =  PEEK (BT + OFF) + 256 *  PEEK (BT + OFF + 1): PRINT LN"
    ";:OFF = OFF + 2
1160 A =  PEEK (BT + OFF): IF MODE$ = "A" AND (A > 127 AND A < 235)
    THEN  PRINT CMD$(A - 128);

1170  IF  PEEK ( - 16384) < 128 THEN 1220: REM CHECK KEYBOARD STROBE
1180 KS =  PEEK ( - 16384): POKE  - 16368,0: IF KS = 193 THEN MODE$ =
    "A": GOTO 1070
1190  IF KS = 212 THEN MODE$ = "T": GOTO 1070
1200  IF KS = 205 THEN MODE$ = "M": GOTO 1070
1205  IF KS = 155 THEN BR$ = "N": RETURN: REM TURN OFF MANUAL MODE
1210 OFF = 512: GOTO 1270
1220  IF A > 31 AND A < 128 THEN  PRINT  CHR$ (A);
1230  IF MODE$ = "T" AND A = 13 THEN  PRINT : GOTO 1250
1240  IF A > 0 AND A < 32 THEN  INVERSE : PRINT  CHR$ (A + 64);:
    NORMAL
1250  IF A = 0 AND (MODE$ = "A" OR MODE$ = "T") THEN  PRINT : IF
    MODE$ = "A" AND (A +  PEEK (BT + OFF + 1) +  PEEK (BT + OFF + 2)
    = 0) THEN  PRINT  CHR$ (7): PRINT "End of DATA":OFF = 512
1260  IF A = 255 AND MODE$ = "T" AND (TYPE$ = "ADB" OR TYPE$(SEL) =
    "AWP" OR TYPE$(SEL) = "ASP") THEN  PRINT : IF (A +  PEEK (BT +
    OFF + 1) = 510) THEN  PRINT  CHR$ (7): PRINT "End of DATA":OFF =
    512
1270  IF OFF >  = 511 THEN  PRINT  CHR$ (7): PRINT : PRINT "End of
    Block "B".": PRINT " Press 'R' to Reject block or any other key
    to accept ": GET AR$: RETURN
1280  IF A = 0 AND MODE$ = "A" THEN OFF = OFF + 3: GOTO 1150
1290 OFF = OFF + 1: GOTO 1160
1300  END
1310  IF DT = 4 THEN TYPE$(A) = "TXT": RETURN
1320  IF DT = 6 THEN TYPE$(A) = "BIN": RETURN
1330  IF DT = 15 THEN TYPE$(A) = "DIR": RETURN
13    IF DT = 25 THEN TYPE$(A) = "ADB": RETURN
13    IF DT = 26 THEN TYPE$(A) = "AWP": RETURN
1360  IF DT = 27 THEN TYPE$(A) = "ASP": RETURN
1370  IF DT = 252 THEN TYPE$(A) = "BAS": RETURN
1380  IF DT = 253 THEN TYPE$(A) = "VAR": RETURN
1390  IF DT = 254 THEN TYPE$(A) = "REL": RETURN
1400  IF DT = 255 THEN TYPE$(A) = "SYS": RETURN
1410 TYPE$(A) =  STR$ (DT): RETURN
1420  IF HR THEN  PRINT: PRINT  CHR$ (7): PRINT "Done!  Do you wish
    to see the Hi-Res    picture...(Y/N)": GET ZZ$: IF ZZ$ = "Y",
    THEN  HGR2 : PRINT  CHR$ (4)"BLOAD "N$(SEL)",A$4000": POKE  -
    16302,0: END
1430 HOME: PRINT: PRINT  CHR$ (7): PRINT "Done!      Please LOAD &
    check the file, "N$(SEL): TEXT: END
```


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very simple, it only slightly resembles a machine language program. The only real machine language is the original call to the MLI and the error handler. One nice thing about the read and write routines is that the only difference between them is the command number of $80 and $81. Therefore, the command numbers 128 or 129 can just be POKEd into the correct, location causing the routine to read or write a block.

ProDOS.UNDELETE POKEs this routine into memory in line 190. Since the routine is short, it is easier to just POKE it into memory rather than BSAVE it. The routine in lines 90-150 then POKEs in the appropriate blocks to read and appropriate buffer to read to. The read/write command is passed to this subroutine by setting CD to 128 for read, or 129 for write. The actual MLI caller is installed into $2E3-$2FF, the end of the keyboard buffer. That is safe enough in this program because the only inputs are one key command entries. If you were using this routine in another program with possible long keyboard inputs, then you would need to relocate it, probably to $300. The variable ML in lines 90-150 was put there to make it easier to relocate. Just remember that you must change ML in line 190 also. If you relocate this routine, then you must also change the fifth and sixth data bytes in line 190 to point to the parameter list at the new location. If you moved the routine to $300 (768), then ML = 768 and the data bytes would change from "236,2" to "9,3".

If the MLI routine detects an error, it immediately rings the bell and prints a number to the screen. The most common error messages are $27 for I/O error, $28 for No device connected, and $2B for Disk write protected.

The first parameter, the device number, may need a little more explanation for use in other applications. This one byte needs to pass to the MLI the slot number and the disk drive number to use. That isn't difficult to communicate if different bits of the byte are assigned to carry each number. Bits 0-3 are unused, bits 4-6 carry the slot number, and bit 7 carries the drive number. Since a bit can only have values of "0" and "1," then bit 7 must be set to "0" for drive #1 and "1" for drive #2. What this all comes down to is that slot 6, drive #1 equals $60 (96) and slot 6, drive #2 equals $E0 (224). In general, this formula will give the device number (DN) to POKE into the parameter list, DN = (128 * (DRIVE - 1)) + 16 * SLOT. These subroutines should make it fairly simple to create your own ProDOS direct read/write programs.

Disassembled Listing of the MLI Caller which is POKEd in by Line 190

```
02E3-   20 00 BF        JSR     $BF00    call the MLI, command follows
02E6-   80               ???              $80 is read command
02E7-   EC 02                             address of parameter list
02E9-   D0 08            BNE     $02F3    jump to error handler if err
02EB-   60               RTS              return from MLI
02EC-   03                                3 parameters for read comnd
02ED-   60                                device no. for Slot 6, Dr #1
02EE-   00 08                             buffer address (Low, High)
02F0-   02 00                             block number to read
02F2-   60               RTS              return from parameters
02F3-   20 DA FD        JSR     $FDDA    print ProDOS error number
02F6-   20 3A FF        JSR     $FF3A    ring bell for ERROR
02F9-   20 BE FD        JSR     $FDBE    print a carriage return
02FC    60               RTS              return from error handler
```


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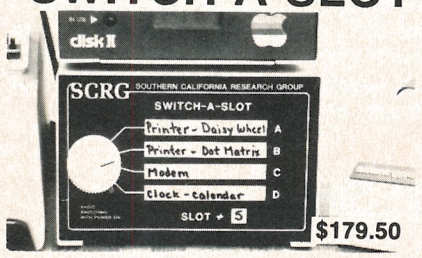

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ProDOS MLI & Assembler Macros Part 2

Ken Kashmarek

WE are back with more of MLI & Macros. Last time, we looked at some simple macros for using the MLI and exercised MLI functions that were not very complicated. This time, we are going to expand on our macro usage and add facilities to our program to perform general purpose file copying. As before, our program will use MLI functions and macro facilities, leaving the menu handling, keyboard input, and screen output to be supplied as an exercise for the reader. At the end of our discussion last time, we elaborated on some of the changes we will focus on here.

First of all, turn to Listing 3. We have taken advantage of two Merlin Pro features. The macros used last time in Listing 1 have been moved to a separate file (/MLI.MACROS/MACROS.S), and the MLI error routine has been moved (/MLI.MACROS/MLIERROR.S). The macros are loaded in line #9, and the MLIERROR routine is loaded in line #46. These files begin with LST OFF and end with LST ON to cut down on the assembler generated output. Merlin Pro adds the suffix ".S" to the pathname. The error routine has not changed.

Generalized File Copy

The file and buffer definitions have not changed, but the program makes use of several new macros to perform the file copy operation. GETINFO is used to obtain information about the files. If the output file does not exist, then CREATE is used to create a new file.

OPEN, READ, WRITE, and CLOSE are unchanged from last time, except for the addition of end of file testing in READ. The big changes are in lines 37 through 44 using GETMARK, SETEOF, and SETINFO.

Let's go back to the top and take a closer look at the macros. Listing 4 provides the complete set of macros, including new and changed macros.

Macro Changes and Improvements

The READ macro was updated to allow for end of file testing and jump to a routine to handle this condition. The first change in the READ macro definition is use of the MOVEW (move word) macro which will be discussed shortly. The MLIE macro call has two new operands. The third operand is a test indicator and the fourth operand is a jump address. In line #67, the MLIE call has E as the third operand, and passes along]4 from the READ macro call (E indicates to expand code for end of file testing).

Examine the test, IF 0=]3, in line #9. I have chosen to use the character 0 as an indication of an absent macro parameter. Macros must be flexible, so code is needed to test for optional parameters. The IF opcode takes the first byte, the character 0, and tests to see if it is equal to the first character of the macro operand,]3 (equal is the only comparison performed). If the first character of the third parameter is 0, we generate code to test for an error condition. If it is not 0, we will test the value of the third operand to determine if we should generate code for end of file checking (E=]3) or file not found (F=]3). Notice the F option invokes the FOUND macro and the E option invokes the ENDFILE macro. With EXP ON, assemble the READ macro both ways to see the generated code:

```
EXP   ON
READ  FILE1;DATAREA; #256;0
READ  FILE1;DATAREA; #256;ENDFILE1
EXP   OFF
```

To perform the conditional assembly, we have used the opcodes IF, ELSE, and FIN to control code generation. When the test is true, the statements between IF and ELSE are processed by Merlin. If the test is false, then Merlin skips to the ELSE opcode and processes statements from ELSE to FIN. The grouping may be of the form:

IF (true) ELSE (false) FIN, or

IF (true) FIN

You will note another change compared to our previous version of the READ macro. Last time, the length value was coded as an absolute value (i.e., 256). This time, the parameter is coded as #256, which brings us to our next topic.

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The statement MOVEW #]2;]1+55 appears in the READ macro. The definition for MOVEW appears in lines 157-163. MOVEW uses LOAD]1 followed by STORE]2. The LOAD macro is used to handle several different operands:

```
LOAD 0        ;no code expansion
LOAD 256      ;load word from locations 256/257
LOAD #256     ;load constant of 256 ($00/$01)
LOAD ABLE     ;load word from location ABLE
LOAD #ABLE    ;load #ABLE and #ABLE/256
LOAD (ABLE)   ;load from zero page pointer ABLE
```

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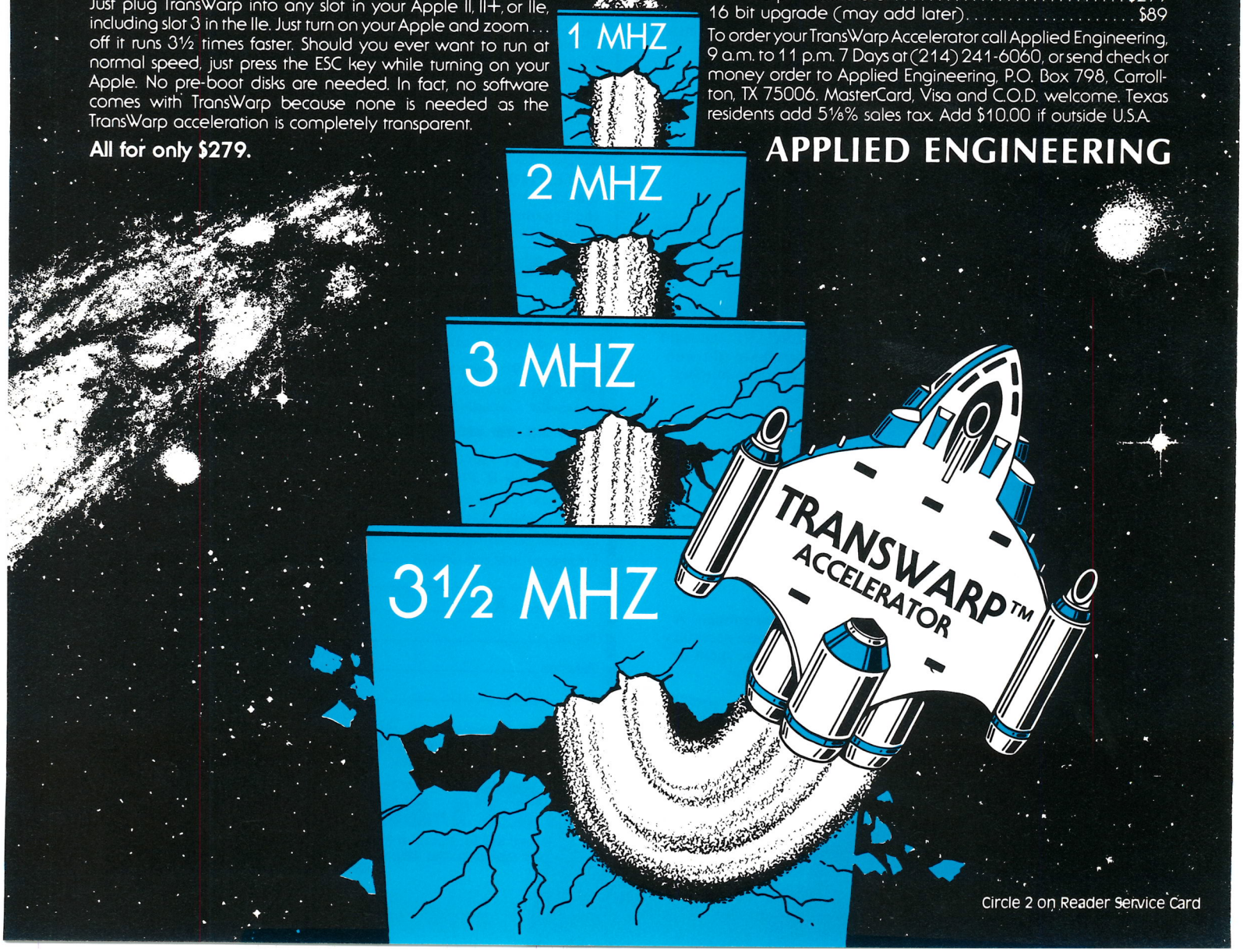

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LISTING 3

```
                        1    * The ProDOS MLI & Assembler Macros
                        2    *
                        3    * Listing 3: Generalized File Copy
                        6    *
                        7    * Macro Definitions
                        8    *
                        9             USE    /MLI.MACROS/MACROS
                       10    *
                       11    * Check out the files
                       12    *
                       13             GETINFO FILE1;NOFILE1;#0;#0
                       14             GETINFO FILE2;NOFILE2;FILE1+24;NOTYPE2
8043: 4C 81 80         15             JMP    PROCEED
8046: 20 9C 81         16    NOTYPE2  JSR    MLIERROR
8049: 20 9C 81         17    NOFILE1  JSR    MLIERROR
                       18    *
                       19    * Create output file if needed
                       20    *
                       21    NOFILE2  CREATE FILE2;FILE1+24;FILE1+25;FILE1+34
                       22    *
                       23    * Open the files
                       24    *
                       25    PROCEED  OPEN   FILE1
                       26             OPEN   FILE2
                       27    *
                       28    * Copy the file data
                       29    *
                       30    LOOP     READ   FILE1;DATAREA;#256;ENDFILE1
                       31             WRITE  FILE2;DATAREA;FILE1+59
80FC: 4C B5 80         32             JMP    LOOP
                       33    *
                       34    * Finish up processing
                       35    *
                       36    ENDFILE1 CLOSE FILE1      ;done with this file
                       37             GETMARK FILE2    ;find output file position
                       38             SETEOF FILE2     ;set as new file length
                       39             CLOSE FILE2      ;done with this file
                       40             GETINFO FILE2;NOFILE2;#0;#0
                       41             MOVEW FILE1+30;FILE2+30 ;date field
                       42             MOVEW FILE1+32;FILE2+32 ;time field
                       43             MOVEB FILE1+23;FILE2+23 ;access bits
                       44             SETINFO FILE2;NOFILE2
819B: 60               45             RTS
                       46             PUT    /MLI.MACROS/MLIERROR
                       47    *
                       48    * File control blocks
                       49    *
81DD: 16 AF CD         50    PATH1    STR    "/MLI.MACROS/TEST.FILE1"
81F4: 16 AF CD         51    PATH2    STR    "/MLI.MACROS/TEST.FILE2"
                       52    FILE1    FCB    PATH1;BUFFER1
                       53    FILE2    FCB    PATH2;BUFFER2
828B: 00 00 00         54    DATAREA  DS     256,0
838B: 00 00 00         55             DS     \          ;256 byte boundary
8400: 00 00 00         56    BUFFER1  DS     1024,0
8800: 00 00 00         57    BUFFER2  DS     1024,0

--End assembly, 3072 bytes, Errors: 0
```

In all cases (except LOAD 0), the A-reg is loaded with the low byte of the symbol or value from the symbol address, and the X-reg is loaded with the high byte of the symbol or value from the symbol address. This macro makes extensive use of conditional assembly. In the case of the zero page indexed load, the Y-reg must be set first, and is left at the same value after execution of the macro code. The STORE macro is similar except for the # operand. Use of these two macros allows several different types of parameters to be used as macro operands.

The READ and WRITE macros are not concerned about the data address operand or length operand. Both use MOVEW to move the data address pointer (#]2) and length (]3) to the parameter list. The third operand, byte request count, can be coded as #256 (read up to 256 bytes; see line #30), or as FILE1+59 (use the READ byte transfer count as the byte request count for writing; see line #31 of Listing 3).

While LOAD and STORE work with two byte (word) operands, this same concept can be extended to single byte operands. Examine the macro for MOVEB (move byte; line #164). In this case, all of the conditional assembly is included in the same macro definition. This macro is used in GETINFO, SETINFO, and CREATE.

Essentially, we have generalized our macro definitions to deal with many different types of operands. The choice of '#' to indicate an immediate operand, and '(' to indicate an indexed operand, were based on current assembler syntax. You may choose any characters that you desire to indicate the mode of assembly for different operands. In our set of macros, LOAD, STORE, and MOVEB are considered the low level macros. The definition of higher level macros is simplified by use of lower level macros. CREATE is built using three macros and five macro calls. Without MOVEB and MOVEW, CREATE is a long string of hard to read LDA and STA instructions. In the present form, it is easy to observe that we are moving one byte with file type, two bytes of subtype (or aux_type)

(Continued on page 38)

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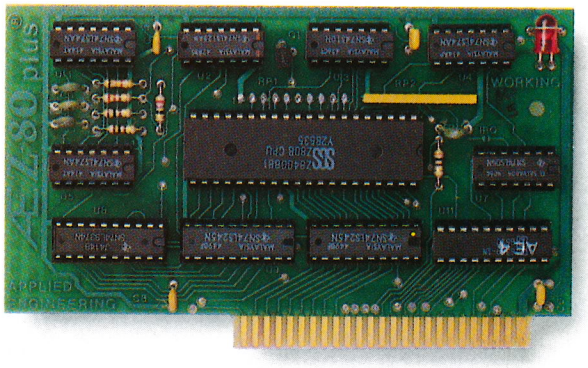

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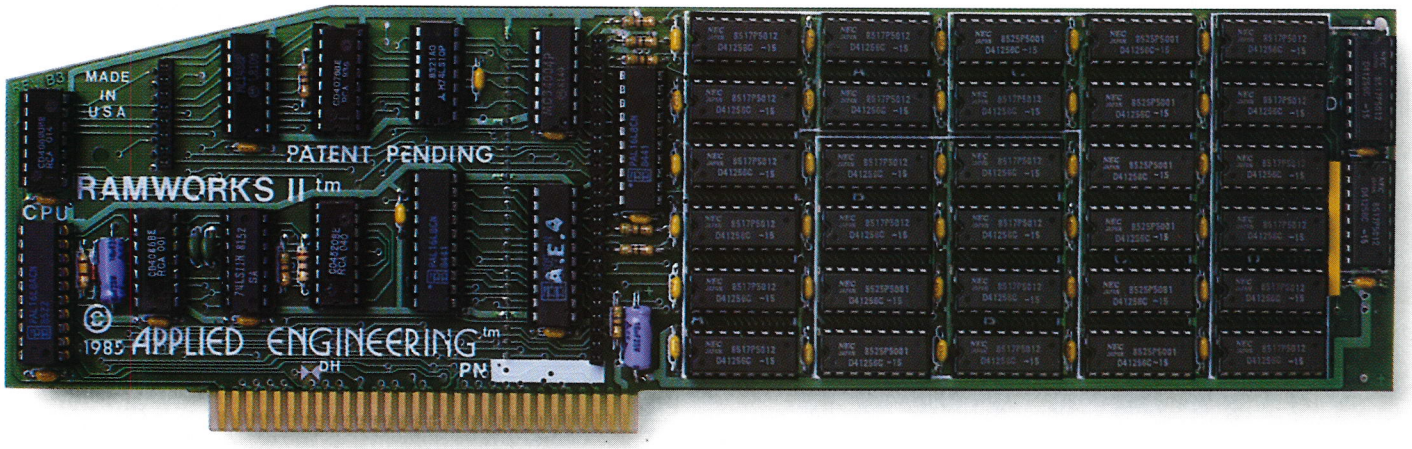

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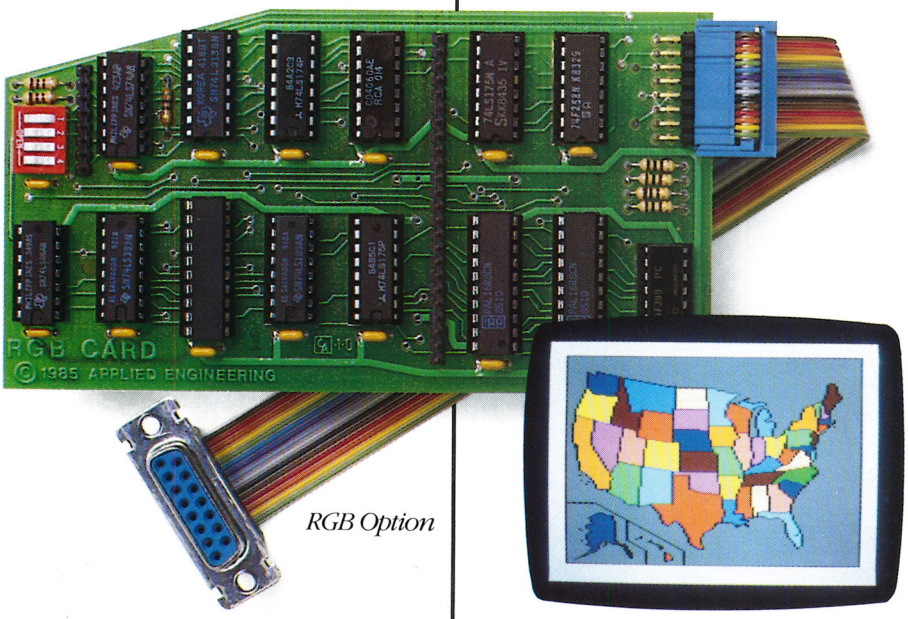

RGB Option

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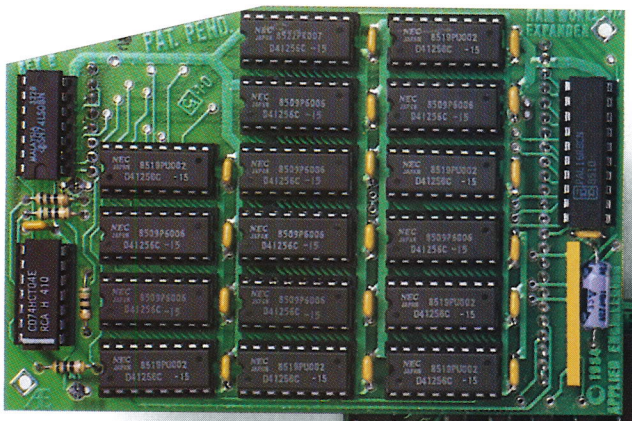

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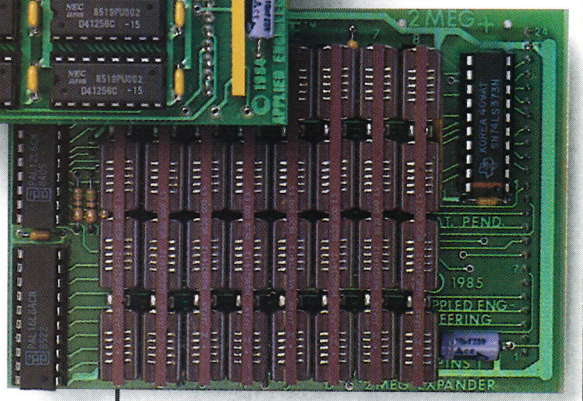

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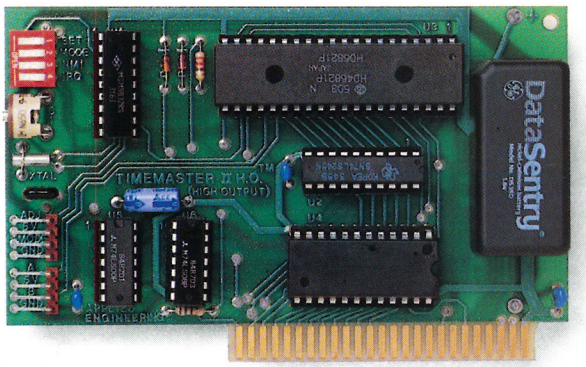

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information, a date field, and time field to the create parameter list. This is immediately followed by the create ($C0) MLI call. With EXP OFF, you will notice Merlin pause when assembling the CREATE call in line #21 of Listing 3.

Now, Back To Our Progam

Line #13 is the GETINFO call for FILE1. If the file is not found, we will use our abbreviated error routine. The FOUND macro is used to perform this test.

The ProDOS MLI does not perform checking for file type. Therefore, the GETINFO macro uses the MATCH macro to check the file type. If the operand is coded as 0, then MATCH does not generate code. At this point, FILE1 may have any file type.

Line #14 is the GETINFO call for FILE2. In this case, if the file is not found, we will jump to the CREATE macro. If FILE2 is found, we want the file type to match that of FILE1. Therefore, input to the GETINFO macro for the third operand is the file type field of FILE1, obtained by the successful GETINFO call for FILE1 (FILE1+24). If the type matches, jump to PROCEED to open the files. Otherwise, we have an error.

Line #21 will create a new file for FILE2. Input to the create MLI call is the information in the parameter list, plus the file type from FILE1 (second operand), the subtype field (auxpe, or FILE1+25, which must be copied over), and the FILE1 create date and create time from the GETINFO call for FILE1 (fourth operand, FILE1+34). The file access code, $C3, is set by the FCB macro in the create parameter list (unlocked, can be written).

At lines 25 and 26, the files are opened for processing, followed by the loop which reads and writes the data. In line #30, the byte request count is 256. The number of bytes actually transferred is returned by the MLI to the parameter list. This value is used as the byte request count for writing (FILE1+59).

When there is no more data in FILE1, the code is executed beginning at line #36. Since we no longer have a need for FILE1, it is closed. Next, the GETMARK call is used to find the current file position for FILE2. This is followed by the SETEOF call to set the end of file pointer (file length) for FILE2. Note that GETMARK returns the mark value to the same parameter list used by SETEOF to set the eof value. We then close FILE2. If these two steps are not performed, the end of file value for FILE2 may be incorrect (if FILE2 already existed). If FILE2 was originally shorter than the data copied to it, these steps are not necessary. If FILE2 was longer, the eof value must be set to reflect the new file length. Excess blocks in FILE2 that are no longer needed will be freed by ProDOS.

Lastly, we perform a GETINFO call for FILE2 in line #40 to set up the parameter list with current information about the file. We then move the FILE1 modification date and time fields to the parameter list for FILE2, plus the access byte from FILE1 (if the input file is locked, then the output file will also be locked). The SETINFO call performs the final update to the directory block.

Line #40 through #44 are not absolutely necessary. This update is performed so the output file essentially mirrors the input file in the directory entry as well as the data. However, if the output file already exists, this program will not change the create date and time. In order to do this, FILE2 must first be deleted and then recreated. This is left as an exercise for the reader (you will have to code a DELETE macro, insert the delete call after line #14, and always jump to the create macro call upon successful completion of the delete).

Is That All?

Hardly! But, before we move on, a few comments about assembling and using macros. From Listing 3, we have about one page of code for our program. In fact, all of the program logic is contained in 32 lines of code (lines 13 through 44). If we use EXP ON, this one page listing expands to seven pages! However, this also includes the macro call lines and EOM lines.

If we use EXP ONLY (expanded code only), we get five pages of assembler output. This is somewhere between 250 and 300 lines of code to create tne same program without macros. We may end up doing that anyway for optimization of the program. However, by us-

LISTING 4

```
 1               LST    OFF
 2 MLI           MAC                  call_number;parameter_list
 3               JSR    $BF00
 4               DB     ]1
 5               DW     ]2
 6               EOM
 7 MLIE          MAC                  call;parms;test;jump
 8               MLI    ]1;]2
 9               IF     0=]3
10               BCC    *+5
11               JSR    MLIERROR
12               ELSE
13               IF     F=]3
14               FOUND  ]4
15               ELSE
16               IF     E=]3
17               ENDFILE ]4
18               FIN
19               FIN
20               FIN
21               EOM
22 FOUND         MAC                  notfound
23               BCC    OKAY
24               CMP    #$44
25               BLT    ERROR
26               CMP    #$47
27               BGE    ERROR
28               JMP    ]1
29 ERROR         JSR    MLIERROR
30 OKAY          EOM
31 ENDFILE       MAC                  eof
32               BCC    OKAY
33               IF     0=]1
34               ELSE
35               CMP    #$4C
36               BNE    *+5
37               JMP    ]1
38               FIN
39               JSR    MLIERROR
40 OKAY          EOM
41 MATCH         MAC                  file;type;nomatch
42               IF     0=]2
43               ELSE
44               LDA    ]2
45               CMP    ]1+24
46               BEQ    *+7
47               LDA    #$4B
48               JMP    ]3
49               FIN
50               EOM
51 OPEN          MAC                  file
52               MLIE   $C8;]1+43;0;0
53               LDA    ]1+48
54               STA    ]1+39
55               STA    ]1+50
56               STA    ]1+54
57               STA    ]1+62
58               EOM
59 READ          MAC                  file;datarea;length;eof
60               MOVEW  #]2;]1+55
61               MOVEW  ]3;]1+57
62               MLIE   $CA;]1+53;E;]4
63               EOM
64 WRITE         MAC                  file;datarea;length
65               MOVEW  #]2;]1+55
66               MOVEW  ]3;]1+57
67               MLIE   $CB;]1+53;0;0
68               EOM
69 CLOSE         MAC                  file
70               MLIE   $CC;]1+61;0;0
71               LDA    #0
72               STA    ]1+39
73               STA    ]1+50
74               STA    ]1+54
75               STA    ]1+62
76               EOM
77 FCB           MAC                  path;buffer
78               DB     7             --->CREATE
79               DW     ]1
80               DB     $C3,0,0,0,1,0,0,0,0
81               DB     1             --->PREFIX;DELETE
82               DW     ]1
83               DB     2             --->RENAME
84               DW     ]1,]1+64
85               DB     10            --->GET/SET INFO
86               DW     ]1
87               DB     0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
88               DB     2             --->MARK,EOF,BUF
89               DB     0,0,0,0
90               DB     3             --->OPEN
91               DW     ]1,]2
92               DB     0
93               DB     3             --->NEWLINE
94               DB     0,0,0
95               DB     4             --->READ,WRITE
96               DB     0,0,0,0,0,0,0,0
97               DB     1             --->FLUSH,CLOSE
98               DB     0,0
99               EOM
100 GETINFO      MAC                  file;notfound;type;nomatch
101              MOVEB  #10;]1+20
102              MLIE   $C4;]1+20;F;]2
103              MATCH  ]1;]3;]4
104              EOM
105 SETINFO      MAC                  file;notfound
106              MOVEB  #7;]1+20
107              MLIE   $C3;]1+20;F;]2
108              EOM
109 CREATE       MAC                  file;type;subtype;datetime
110              MOVEB  ]2;]1+4
111              MOVEW  ]3;]1+5
112              MOVEW  ]4;]1+8
113              MOVEW  ]4+2;]1+10
114              MLIE   $C0;]1+00;0;0
115              EOM
116 GETMARK      MAC                  file
117              MLIE   $CF;]1+38;0;0
118              EOM
119 SETEOF       MAC                  file
120              MLIE   $D0;]1+38;0;0
121              EOM
122 LOAD         MAC                  operand
123              IF     0=]1
124              ELSE
125              IF     #=]1
126              LDA    ]1
127              LDX    ]1/256
128              ELSE
129              IF     (=]1
130              INY
131              LDA    ]1,Y
132              TAX
133              DEY
134              LDA    ]1,Y
135              ELSE
136              LDA    ]1
137              LDX    ]1+1
138              FIN
139              FIN
140              FIN
141              EOM
142 STORE        MAC                  operand
143              IF     0=]1
144              ELSE
145              IF     (=]1
146              STA    ]1,Y
147              INY
148              TXA
149              STA    ]1,Y
150              DEY
151              ELSE
152              STA    ]1
153              STX    ]1+1
154              FIN
155              FIN
156              EOM
157 MOVEW        MAC                  source;target
158              LOAD   ]1
159              IF     0=]1
160              ELSE
161              STORE  ]2
162              FIN
163              EOM
164 MOVEB        MAC                  source;target
165              IF     0=]1
166              ELSE
167              IF     #=]1
168              LDA    ]1
169              ELSE
170              IF     (=]1
171              LDA    ]1,Y
172              ELSE
173              LDA    ]1
174              FIN
175              FIN
176              FIN
```

Continued

```
177             IF    Ø=J2
178             ELSE
179             IF    (=J2
180             STA   J2,Y
181             ELSE
182             STA   J2
183             FIN
184             FIN
185             EOM
186             LST   ON
```

ing macros, we have developed a usable and working program that can be quickly changed to deliver the function required. By having a driver routine provide pathnames, control blocks, and error recovery, lines 13 through 45 can serve as a file copy subroutine.

The GETINFO macro provides almost all of the information necessary to perform a catalog display for a single file. We must still get the eof value. In order to obtain eof, open the file, issue GETEOF, and close the file. At this point, we can easily develop the code to display the CATALOG line of output for a file (left as an exercise for the reader). Of course, one other way to get the information is to search the ProDOS file structure to find the file entry itself. This method is necessary to display certain fields from directory entries (file type $0F) or the directory header block.

We now have sufficient information for developing other applications that use files under ProDOS. We need to add a few more macros — SETMARK, GETEOF, PREFIX, DELETE, RENAME, and NEWLINE. NEWLINE? What's a NEWLINE? Patience. It will covered shortly. By using macros for reading data, we can put together a program to provide a TYPE function (display text file) and a DUMP function (display hex and character of any file). At this point, we will turn to processing an Applesoft file (BAS) in a line by line fashion (selectively by line numbers).

An Applesoft File Utility

There are many functional applications that can make use of the ability to read Applesoft program files one line at a time. Examples include: LIST command to display a program from a disk file; COMPRESS command to read a program file, remove REM statements and combine program lines, and write a new compressed copy to a different file; MERGE command to read two separate program files and create a single program file as output; or a COMPARE command to compare two Applesoft program files.

What we will develop here is a functional module to read one Applesoft program file, select lines by line number, and copy those lines to a new file. This will provide the code for reading and writing Applesoft program files. This should be sufficient to serve as a base for developing some of the other functions that were mentioned.

An Applesoft program in memory consists of Applesoft program line(s) followed by the end of program indicator ($0000). If at least one line exists in a program, the minimum length is eight bytes:

2 bytes next line pointer (LO/HI value)
2 bytes Applesoft line number (LO/HI value)
1 byte minimum data for an Applesoft line
1 byte end of line marker ($00)
2 bytes end of program marker ($0000)

Thus, each Applesoft line begins with a pointer, the line number, followed by the tokenized program information, and ends with $00. This information is important for setting up the NEWLINE call (NEWLINE? Where have I heard that before?)

The NEWLINE Function

In our previous program, we set up a request count for 256 bytes of data for each READ macro call. With this type of request, we always obtained 256 bytes of data from the MLI except for the last read, which may have obtained less than 256 bytes. However, ProDOS provides the NEWLINE MLI function which allows a read operation to be terminated based on finding a certain byte value as an end of read indicator. The NEWLINE MLI parameter list contains the following information:

```
DB 3  ;parameter count
DB 0  ;open file reference number
DB 0  ;newline enable mask
DB 0  ;newline character
```

Reference number is set up by the OPEN macro. A mask value of $00 disables the newline character option. This is the default when a file is opened. A non-zero value enables the newline character. Each byte read from the file is ANDed with the enable mask. The result is then compared to the newline character. A match causes the read request to terminate. When BASIC.SYSTEM reads text files (TXT), it uses an enable mask of $7F with a newline character of $0D (return character). Thus, the newline character will get a match whenever $0D or $8D is read from a text file (AND with $7F converts $8D to $0D; a match).

On With The Program

It would appear that we can enable newline mode with a newline character of $00 to read individual Applesoft program lines. However, the first four bytes of each program line can have a $00 byte as part of the next line pointer or the line number. So, we must read the first four bytes of each program line with newline mode disabled, and then read the rest of the program line with newline mode enabled (enable mask = $FF and newline character = $00). $FF is used as the mask to leave all bits alone in each byte read from the file. The read operation will then terminate when a byte with $00 is found.

Turn now to Listing 5 which contains our program. The NEWLINE macro has been added, which is very simple. A compare word macro (CMPW) has been added and is used in comparing line numbers. LOAD is used to place the first operand in the registers. The third operand can be L, E, or G, for less than, equal, or greater than, respectively. The test and jump instructions are generated appropriately (with some work, this macro could be expanded to handle the multiple condition tests for less than or equal, greater than or equal, as well as not equal).

Finally, there is an add word macro (ADDW). Its only option is to store the result back to the second operand or to a third operand. This macro is used to generate the new program line offset pointers.

In this program, we specifically check for Applesoft file type and do nothing with the date and time fields (let ProDOS take care of these). This time, we are not creating an exact copy of the file, but a new file with a subset of the program lines.

The processing loop is in lines 73 through 84. We disable newline mode and read four bytes without end of file checking. Newline mode is then enabled and we read the program line with end of file checking.

For our sample program, we will extract lines 1000 through 2000 (change these values for your own sample program; for my testing, I used the STARTUP program from the ProDOS User's Disk). The values are coded at FIRST and LAST. If the line number just read from the file is less than FIRST, go back to LOOP. If it is greater than LAST, then finish up.

Now, for the tricky part. The next line pointer in each line must be updated before writing the selected lines to the output file. The initial value is taken from the subtype field of FILE1 (FILE1 + 25 obtained with the GETINFO call; normally set to $0801). First, add 4 to the byte transfer count of the input file (FILE1 + 59) for the first four bytes read. Then, add this value (FILE1 + 59) to the subtype field of the input file. Finally, move this value to the pointer field of the Applesoft line. The pointer field must be correct in order to load, list, or run the program lines from the new file. Now, we write the updated line out to FILE2.

At ENDFILE, we write out two bytes of zeros ($0000) to indicate end of the Applesoft program. As before, we get the mark, set the end of file pointer, and close the file.

Speaking of CLOSE . . .

Time to issue SETEOF and CLOSE for now. Next time, we'll open another file and look at some special applications of the MLI.

LISTING 5

```
                        1    * The ProDOS MLI & Assembler Macros
                        2    *
                        3    * Listing 5: Applesoft File Copy
                        6    *
                        7    * Macro Definitions
                        8    *
                        9            USE    /MLI.MACROS/MACROS
                       10    NEWLINE  MAC    file;mask;character
                       11            MOVEB  ]2;]1+S1
                       12            MOVEB  ]3;]1+S2
                       13            MLIE   $C9;]1+49;Ø;Ø
                       14            EOM
                       15    CMPW     MAC    a;b;compare;address
                       16            LOAD   ]1
                       17            CPX    ]2+1
                       18            BNE    RETURN
                       19            CMP    ]2
                       20    RETURN  IF     Ø=]4
                       21            ELSE
                       22            IF     L=]3
                       23            BGE    OUT
                       24            FIN
                       25            IF     E=]3
                       26            BNE    OUT
                       27            FIN
                       28            IF     G=]3
                       29            BLT    OUT
                       30            BEQ    OUT
                       31            FIN
                       32            JMP    ]4
                       33    OUT      FIN
                       34            EOM
                       35    ADDW     MAC    a;b;target
                       36            LOAD   ]1
                       37            CLC
                       38            ADC    ]2
                       39            IF     Ø=]3
                       40            STA    ]2
                       41            ELSE
                       42            STA    ]3
                       43            FIN
                       44            TXA
                       45            ADC    ]2+1
                       46            IF     Ø=]3
                       47            STA    ]2+1
                       48            ELSE
                       49            STA    ]3+1
                       50            FIN
                       51            EOM
                       52    *
                       53    * Check out the files
                       54    *
                       55            GETINFO FILE1;NOFILE1;#$FC;NOTYPE1
                       56            GETINFO FILE2;NOFILE2;FILE1+24;NOTYPE2
804F: 4C 78 80         57            JMP    PROCEED
8052: 20 09 82         58    NOTYPE1  JSR    MLIERROR
8055: 20 09 82         59    NOTYPE2  JSR    MLIERROR
8058: 20 09 82         60    NOFILE1  JSR    MLIERROR
                       61    *
                       62    * Create output file if needed
                       63    *
                       64    NOFILE2  CREATE FILE2;FILE1+24;FILE1+25;Ø
                       65    *
                       66    * Open the files
                       67    *
                       68    PROCEED  OPEN   FILE1
                       69             OPEN   FILE2
                       70    *
                       71    * Copy the file data
                       72    *
                       73    LOOP     NEWLINE FILE1;#Ø;#Ø DISABLE
                       74             READ   FILE1;DATAREA;#4;Ø
                       75             NEWLINE FILE1;#$FF;#Ø ENABLE
                       76             READ   FILE1;DATAREA+4;#250;ENDOFILE
                       77             CMPW   DATAREA+2;FIRST;L;LOOP
                       78             CMPW   Ø;LAST;G;ENDOFILE
                       79             ADDW   #4;FILE1+59;Ø
                       80             ADDW   FILE1+59;FILE1+25;Ø
                       81             MOVEW  FILE1+25;DATAREA
                       82             WRITE  FILE2;DATAREA;FILE1+59
8190: 4C AC 80         83             JMP    LOOP
8193: E8 03            84    FIRST    DW     1000        ;BEGINNING LINE #
8195: D0 07            85    LAST     DW     2000        ;ENDING LINE #
                       86    *
                       87    * Finish up processing
                       88    *
                       89    ENDOFILE MOVEW #Ø;DATAREA ;SET END OF PGM
                       90             WRITE  FILE2;DATAREA;#2
                       91             CLOSE  FILE1       ;done with this file
                       92             GETMARK FILE2      ;find output file position
                       93             SETEOF FILE2       ;set as new file length
                       94             CLOSE  FILE2       ;done with this file
8208: 60               95             RTS
                       96             PUT    /MLI.MACROS/MLIERROR
                       97    *
                       98    * File control blocks
                       99    *
824A: 16 AF CD        100    PATH1    STR    "/MLI.MACROS/TEST.FILE1"
8261: 16 AF CD        101    PATH2    STR    "/MLI.MACROS/TEST.FILE2"
                      102    FILE1    FCB    PATH1;BUFFER1
                      103    FILE2    FCB    PATH2;BUFFER2
82F8: 00 00 00        104    DATAREA  DS     256,Ø
83F8: 00 00 00        105             DS     \          ;256 byte boundary
8400: 00 00 00        106    BUFFER1  DS     1024,Ø
8800: 00 00 00        107    BUFFER2  DS     1024,Ø

--End assembly, 3072 bytes, Errors: Ø
```


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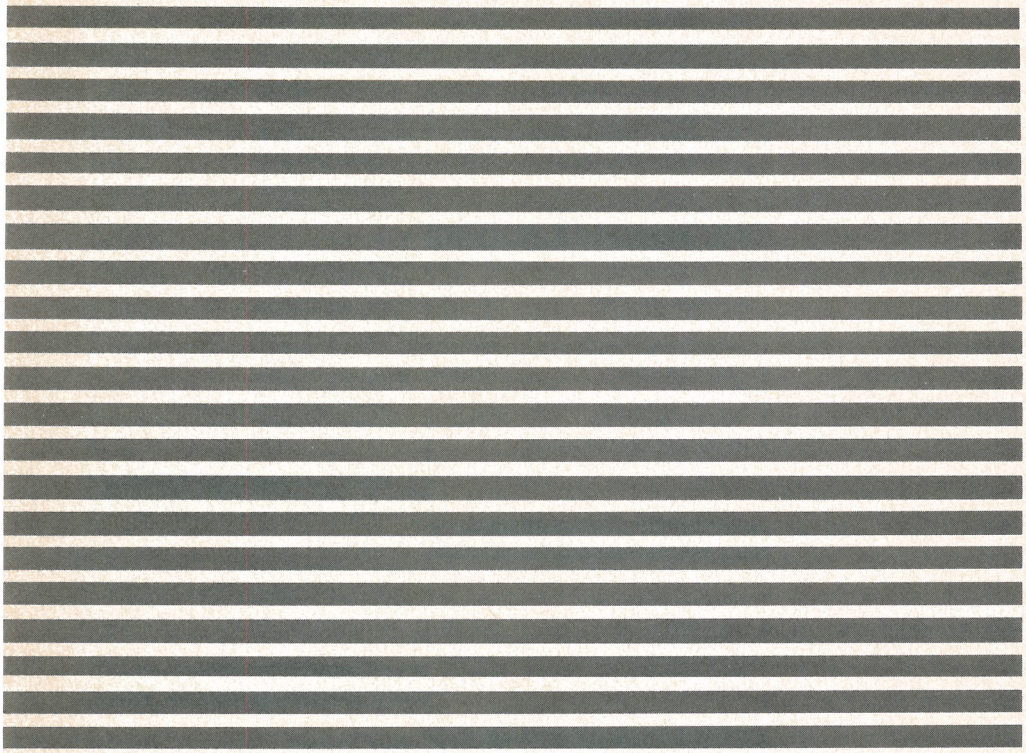
A Lab Instrument Interface—Part 2



David A. Gregg & Daniel J. Macero

AN Apple II+ or Apple *IIe* can be connected to many household or laboratory instruments. In Part 1 we described how to wire some of these devices directly to the game connector. We also showed how to attach an 8 bit analog to digital converter through the peripheral slot connector for the conversion of voltages in the range of 0 to +5 volts. This month we shall describe additional function circuits which allow the converter to read D.C. current, bipolar voltages, and voltages in the millivolt range. A copy of the circuit diagram (Figure 2) and the layout of the components (Figure 3) from Part 1 are necessary for the completion of the wiring of the card. (Figure 1 appeared in Part 1 of this 2 part series.)

Bipolar Voltages

If you were successful in constructing the basic 0 to +5 Volt converter described last time, other circuit components may be added. Before attempting the additional wiring, remove the ADC0804 from its socket using the normal precautions to prevent damage by static electricity. Resistors (R4 and R5) allow the analog input voltage to change from −5 to +5V. Dip switches S5 and S7 allow the two new resistors to be switched in and out of the circuit so that both the 0 to 5V and the bipolar (-5V to +5V) mode of operation are available on the card. The 0 to 5V mode is selected by opening S7 and closing S5. The -5/+5 mode is selected by opening S5 and closing S7. A single, small DPDT switch may be used in place of the two dip switches. However, the switch must be small so as not to protrude into the space reserved for a card in an adjacent slot. We had difficulty finding one of the appropriate size. Before inserting the card into the computer, again make sure that no short exists among the pins along the edge of connector. When operating in the bipolar mode (-5V to +5V), the converter should return a value of about 127 with the inputs grounded. A zero reading should occur with an input of -5V; the 255 should appear with an input voltage of +5V. The +/-mode of operation is necessary when reading voltages from certain instruments—notably a pH meter.

Other Voltage Ranges

To allow the computer to read full scale voltages other than 5V, operational amplifiers are attached to the ADC. The output of the op amp circuit is attached to the input of the converter. The op amps can be used to magnify or diminish the input signal voltage. They can also be used to transform a current into a voltage. All that is required to adjust the gain (amplification) is two resistors. One resistor called the feedback resistor R^f is connected across the op amp between the output and the inverting input. The inverting input is marked with a (-) sign on the circuit symbol for the amplifier. The (-) sign indicates that a signal attached at this point will be inverted when it comes out. That is, a +3V signal entering the inverting input will be converted to a -3V signal if the gain of the amplifier is set to 1. The other resistor is the input resistor R^i. This resistor is connected in series between the signal input and the same inverting input. The amplifier forces the same amount of current to flow through each resistor while holding the inverting input at ground potential. Theoretically, no current will flow through the input of the amplifier. In reality, all op amps do draw current through their inputs. However, even for an op amp of average quality, this current may be only billionths of an ampere. The voltage at the output of the op amp circuit can be calculated by applying the equation $E^o = -E^{in} (R^f/R^i)$, where E^o is the voltage of the output, E^{in} is the voltage of the input signal, and R^f and R^i are the values of the feedback and input resistors. In Figure 2, the values of the resistors associated with the inverting gain amplifier allow the gain of this amplifier to be adjusted from 1 to 63.5 by adjusting the feedback resistors R6, R7, R8, and R9. The maximum feedback resistance is (500k + 100k + 25k + 10k). The input resistor, shown as R10, sets R^i = 10k ohms. The maximum gain is therefore 635/10 or 63.5. By using larger feedback resistors the gain can be made greater. The practical limit for a voltage gain is about 100 for the 741 op amp.

Two diodes at the input to the ADC were added as a precaution to protect its input from accidental noise, filter capacitor (C2) was also needed. The noise was evident by observing that the reading from the converter changed by more than one digit while the analog, input voltage was constant. The noise was much more evident when the card was operating inside the computer using the Apple power supply than when it was tested outside the computer using an external power supply. The value of the filter capacitor was determined by experimenting with several sizes until one large enough to eliminate most of the fluctuations was found. Finally an inverting pre amp was added with an adjustable gain from 1 to 11. Although not absolutely necessary this

amplifier does make the analog signal entering the card have the same polarity when it reaches the input of the ADC. The gain from this op amp may be made larger by using a larger feedback resistance. We chose this overall gain so that the bipolar, chart recorder output from a Corning 125 pH meter could be amplified to the full scale (0-5V) of the ADC. Thus, the two amplifiers connected together result in a gain of 700, which will amplify a 7.2 mV signal to the full scale of 5 Volts.

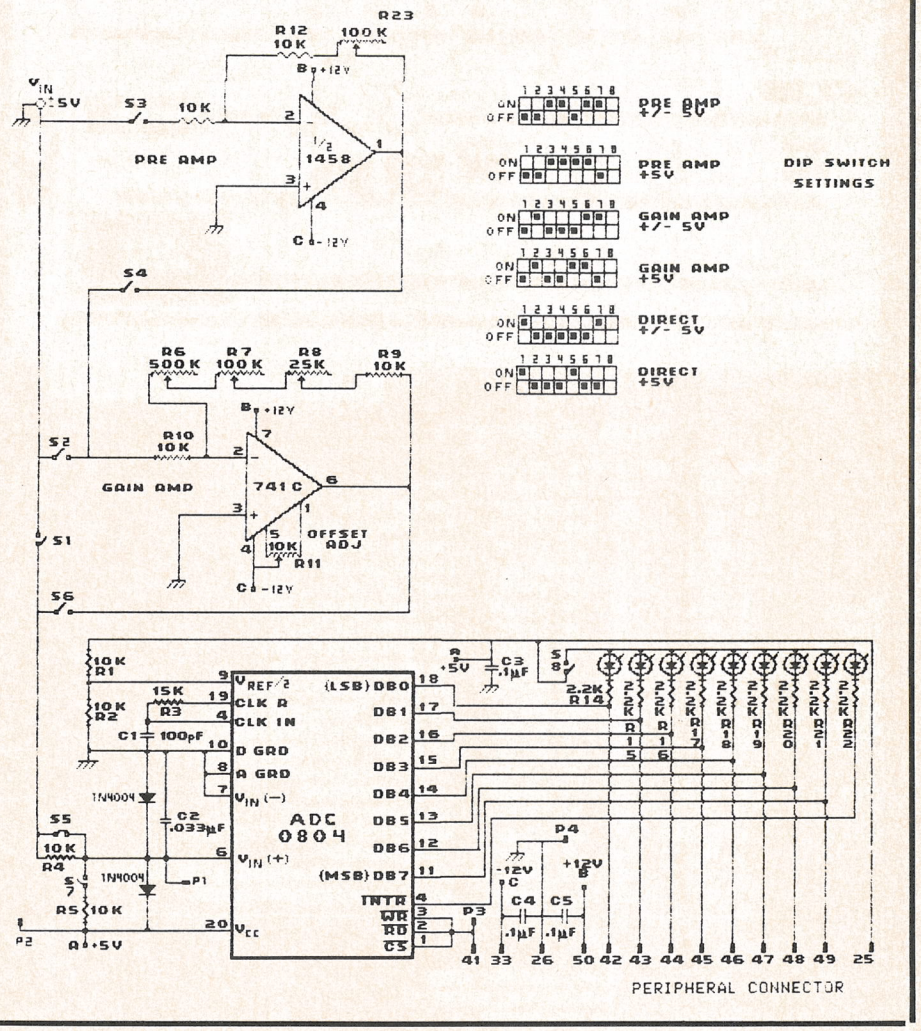
The op amp circuits may be tested outside the computer. To accomplish this, all IC chips on the board — especially the ADC804 chip — should be removed from their sockets. The newly wired circuits should then be tested for shorts with a multimeter. The only potentially serious problem that we had in assembling the card was encountered at this time, i.e., +12V and ground were shorted because of a faulty decoupling capacitor. We had used a .1 uf tantalum capacitor and had not heat sinked the leads when it was soldered. Replacing this capacitor corrected the short. Again, be sure to check for shorts among the unused pins along the peripheral connector. If there are no shorts, the op amps may be inserted into their sockets. Do not put the ADC804 chip in the board until the op amps circuits have been fully tested. Connect the ground, 5V, +12V and -12V leads to an external power supply. The supply we used for testing has +15 and -15V rather than +12 and -12V. The difference in voltage between the Apple supply and the 15 volt supply is acceptable for testing the function of the circuits but not for a final calibration. The voltage outputs from the op amps may be observed using a voltmeter while the adjusting screws on the variable resistors are turned with a small screwdriver. The behavior of the circuit with the various dip switch settings may also be observed at this time.

Switches S1, S2, S3, S4, and S6 control the op amp options. With S1 closed and the other four switches open, the input of the card is connected directly to the input of the ADC. All of the op amps are bypassed in this configuration. With S1 open but S2 and S6 closed, the gain amplifier will be included in the input to the ADC. Remember, using only one op amp will cause the polarity of the signal to be reversed. To include both the preamp and the gain amp in the circuit, S2 should be opened to prevent the input signal from being put on the input of both op amps simultaneously, and both S3 and S4 should be closed. S6 should also be kept closed to connect the output of the op amps to the input of the ADC. The switch diagram on Figure 2 shows the proper settings of the switches for all the amplifier options. Note there is not an option to use only the pre amp. If these functions behave properly, the ADC may be inserted back into its socket and the card tested as before.

We tested the card in slot 4. To make

FIGURE 2

CIRCUIT DIAGRAM FOR 8 BIT A/D WITH ADJUSTABLE FULL SCALE RANGE FROM +/- 7.2 mV TO +/- 5 VOLTS



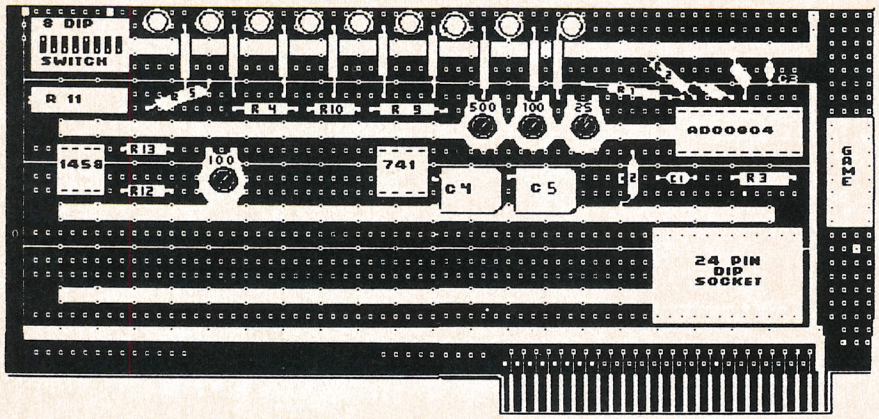
room so that a small screwdriver could be used to turn the pots on the card, all other peripheral cards to the right of slot 4 must be relocated temporarily. Normally this involves just moving the disk controller card from slot 6 to slot 2. The use of a different type of potentiometer would eliminate this minor problem. The final test was to see how well the card could follow the output of a Corning 125 pH meter. The chart recorder outputs from the pH meter were attached to the inputs of the card. Solutions with a pH range from 1.5 to 12 were used. After adjusting the gain on the card so that a 1.5 to 12 pH range causes a nearly full scale reading, the computer reproduced the pH reading on the meter to within .05 pH units over the full range. Because of my concern about the noise from the op amp circuits, we looked at the input to the ADC at P1 with an oscilloscope. With the pH meter in place there was a .1 volt high frequency, greater than 10 Mhz, signal evident. Additional filter capacitance did not reduce the noise significantly; however, it is important to note that despite a signal that looked rather noisy, the converter tracked the output of the pH meter to within 1 bit over the full range. This accuracy is within the chip specifications. The noise apparently looks worse than it functionally is. One may feel confident that the card has the ability to track signals with ranges in voltage from 8 mV to 5V to a precision of .4% (1/256).

Other Functions

For the card to act as a multimeter for fixed voltage ranges and current ranges, another op amp or two is required. These circuits may be affixed to the card, but my own preference is to have these circuits contained in a box that can be physically located outside the computer. This will make it easier to make external connections. Knobs that can be easily turned by hand can be used and adjustments made without reaching into the computer. In addition, the connections from the game paddle can be extended into the box so that it can be used as an exceptionally versatile point of connection to the computer. The lines running to the box can include all lines from the game paddle connector, the line to the A/D converter on the card, and the +12, -12, and -5V supply voltages from the peripheral connector.

FIGURE 3

LAYOUT OF COMPONENTS ON PROTOTYPING BOARD



VOLTAGE CARD PARTS LIST

	QUAN	UNIT	UNIT PR	TOTAL	PART NR¥	DESCRIPTION
	1	EA	.89	.89	276-7	741C OP AMP
	1	EA	.99	.99	276-038	1458 DUAL OP AMP
	1	EA	1.99	1.99	275-1301	8-POSITION DIP SWITCH
	1	PK 2	.59	.59	276-1995	8 PIN LOW PROFILE SOCKET
	1	PK(20)	1.98	1.98	276-1622	ASSORTED LEDS (20)
	1	EA	.59	.59	276-1991	20 PIN LOW PROFILE DIP SOCKET
R14-R22	2	PK 5	.39	.78	271-1325	2.2K OHM RESISTOR 1/4 WATT
R1,R2	1	PK 2	.29	.29	271-155	10K OHM RESISTOR 1 WATT
R4,5,9,10,12,13	4	EA	.19	.76	271-034	10 K OHM RESISTOR 1/2 WATT
R3	1	PK 2	.19	.19	271-036	15K OHM RESISTOR 1/2 WATT
R11	1	EA	1.49	1.49	271-343	10K MULTITURN POTENTIOMETER
R8	1	EA	.49	.49	271-336	25 K OHM PC POTENTIOMETER 1/8 WATT
R23,R7	2	EA	.49	.98	271-338	100 K OHM MINI PC POTENTIOMETER
R6	1	EA	.49	.49	271-339	500 K OHM PC POTENTIOMETER 1/8 WATT
C3	1	EA	.49	.49	272-1432A	.1 MFD TANTALUM CAPACITIOR
C4,C5	1	PK 2	.79	.79	272-1069	.1 MFD PC CAPACITORS
C1	1	EA	.69	.69	272-152	100 pF CERAMIC CAPACITOR
C2	1	PK 100	1.98	1.98	272-801	ASSORTED DISC CAPACITORS (FILTER)
	1	PK 2	.99	.99	276-1104	1N4004 TRANSISTOR
	1	EA	4.05	4.05	ADC0804 LCN	8 BIT A/D CONVERTER W/TRISTATE BUFFER LATCHES¥¥
	1	EA	24.00	24.00	A2B0001X	APPLE II HOBBY/PROTOTYPING BOARD¥¥¥
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FIGURE 4

FUNDAMENTAL OP AMP CIRCUITS

OPERATIONAL AMPLIFIER WIRED TO CONVERT CURRENT TO VOLTAGE WITH AMPLIFICATION IN 4 FIXED RANGES

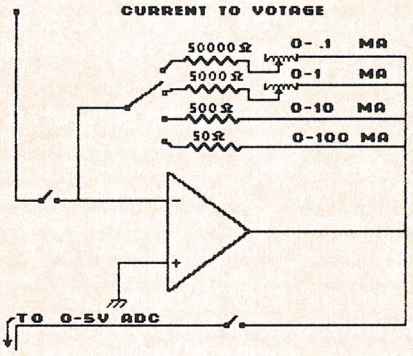
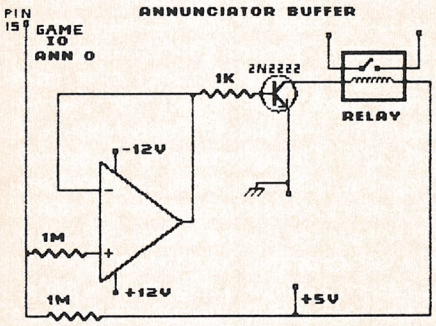


FIGURE 5

CIRCUIT TO DRIVE RELAY FROM GAME CONNECTOR



In its final form, the interface card in the computer contains two additional dip sockets. One is a 16 pin socket which allows a jumper from the game connector to be attached. The other is a 24 pin socket which allows one cable containing all the game connector lines, the line to the input of the ADC, and the additional supply voltage lines to extend from the back of the computer. This cable runs to a connector box which contains RCA jacks, banana plug connectors, switches, relays, and op amp circuits. The one "standard cable" can be used to attach different connector boxes, instruments, or student projects.

Figure 4 shows how to connect a 741 op amp to convert a current to a voltage which in turn may be read by the card. Note that the current to be measured is connected directly to the inverting input of the op amp. The 10 ohm feedback resistor will have the effect of making the voltage output of the op amp 10 times the current (in amperes) in the circuit to be measured. In this configuration, the op amp forces the current in the feedback resistor to equal the current in the circuit under measurement. The voltage drop across the feedback resistor is $-i^fR^f$. Since the inverting input is at ground, the output of the op amp is the same as the voltage drop across the feedback resistor. A current of .1 amp in the circuit to be measured results in a 1 V output from this op amp circuit.

Figure 5 shows how to attach a relay using one of the annunciator lines from the game paddle connector. With a relay, the computer can switch on and off equipment that operates from a standard 115 V A.C. circuit. Remember to decouple the 12V supply lines with .1 uF capacitor if they were not decoupled elsewhere.

Figure 6 shows the circuits for making a current-voltage multimeter with various fixed ranges. The zener diode on the output of op amp circuits prevents large transient voltage surges on the A/D input while the switches to the resistors are being thrown. If a switch is in an intermediate position, the full open loop gain of the amplifier will be felt at the output. The optional, variable, trimming resistors allow one to fine tune each range of the multimeter.

In addition to the built in capabilities of the game connector, the ability to sense voltages makes the Apple a very versatile tool for the laboratory. Any instrument containing a built in ammeter or voltmeter can be attached to the computer using this interface. Measurements of electrical conductance, pH, temperature and light intensity, for example, can be easily made by an Apple. The computer's abilities to process, display, store, and transmit data, combined with the computer's ability to acquire this data directly, adds a fascinating dimension to the computer's use.

References

National Semiconductor Linear Data Reference Book, Santa Clara CA: National Semiconductor Corp.

R. K. Behm, "The Apple pH Meter," *Journal of Chemical Education,* Vol 60, Number 7, July 83, p. 567.

Archer Semiconductor Reference Guide, Fort Worth TX:Tandy Corp. (1982).

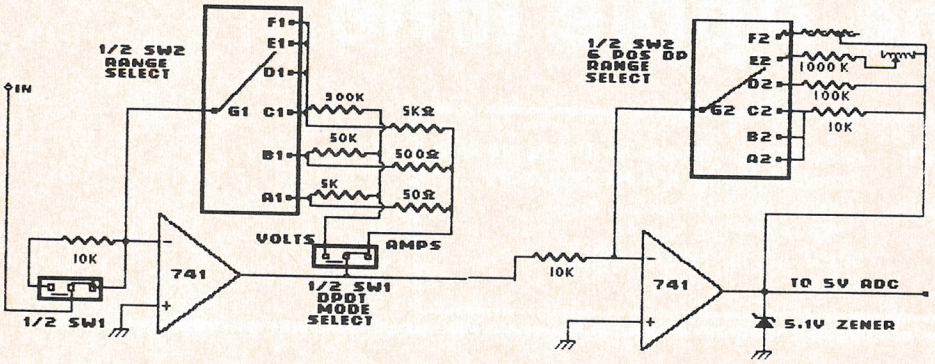
J. A. Titus et al, *Apple Interfacing,* Indianapolis IN: Howard W. Sams (1981).

Apple II Reference Manual, Cupertino CA: Apple Computer (1981).

FIGURE 6

CURRENT – VOLTAGE MULTIMETER

THE CIRCUIT DIAGRAM SHOWS HOW TO WIRE SWITCHES TO COMBINE A VOLTAGE AMPLIFIER AND A CURRENT AMPLIFER. THE DIAGRAM SHOWS ONE 6 POSITION DOUBLE POLE SWITCH FOR RANGE SELECTION AND ONE DPDT SWITCH TO SELECT EITHER THE CURRENT OR VOLTAGE MODE OF OPERATION



RANGE	MAXIMUM VOLTS	RANGE AMPS
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B	1.0	.010
C	0.10	.0010
D	0.010	.00010
E	0.0010	.000010
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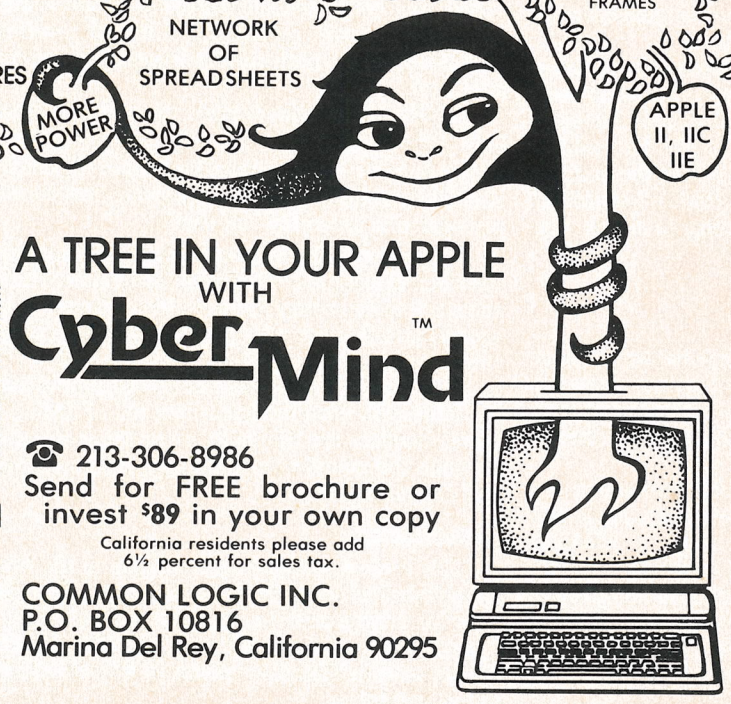

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Review of "Assembly Cookbook for the Apple II/IIe"

Product:	Assembly Cookbook for the Apple II/IIe
For:	Assembly Language Programmers
Company:	Howard W. Sams & Co. Inc.
	4300 West 62nd Street
	Indianapolis, Indiana 46268
Price:	$21.95

Michael Ching

DON Lancaster has done it again. In his inimitable style, he has produced 408 pages of clearly written and neatly illustrated text in the form of a book called, *Assembly Cookbook for the Apple II/IIe.* My problem was that I had a bit of difficulty figuring out just who this book was written for.

Mr. Lancaster states emphatically that you should not even think about reading this book until you are thoroughly familiar with *machine* (not assembly) language. "To continue, you must know about and must have used 6502 opcodes, and must completely and thoroughly understand addressing modes and hexadecimal notation. Memory maps, working registers, and address space must be second nature to you. You must also have already *handwritten* and debugged several of your own machine language programs."

This seems an odd way of going about it, since people who program purely in machine language are about as common as color Macintoshes. What could possibly be his reasoning for saying this? Well, Mr. Lancaster happens to be one of the microcomputer pioneers, and probably had to first struggle with machine language without the benefit of an assembler. In any case, if a person were to become successful at writing programs in machine language, learning assembly language would become a simple task.

What is more likely to happen, I fear, is that after several minutes of staring at raw hexadecimal dumps, you will soon throw up your hands in confusion and scurry back to your familiar, safe, but slow Applesoft. My suggestion, in direct opposition to Mr. Lancaster's advice, would be to instead first work through one of the easy introductions to assembly language such as Randy Hyde's *Using 6502 Assembly Language* (Datamost) before attempting to tackle this book.

Learning the Assembler

Assembly Cookbook starts off with a preliminary chapter of "Why You Gotta Learn Assembly Language." There are many reasons not to use assembly, since it is hard to write, debug, and maintain. But there remains one assailable fact: there are certain effects that can be done *only* in machine or assembly language.

After the preliminaries, the book is divided into two major sections. The first one, Part 1, explains what an assembler is and how it is used. The particular assembler used is Apple's EDASM assembler (sometimes known as the "Tool-Kit Assembler"). This section proves to be far more than a mere instruction manual for the assembler. Scattered throughout the explanatory text are gems of wisdom which can only be earned through years of experience programming in assembly language. It is these little hints that set the tone of this entire book.

Included in Part 1 is a statement that is sure to make the Pascal aficionado swallow hard. The statement reads (in bold print, highlighted in a red bordered box), **ALL STRUCTURE IS INHERENTLY AND INTRINSICALLY EVIL!"** Now before you run off and begin indiscriminately replacing all your GOSUBs with GOTOs, this should not be taken at face value. As much as anything, it is intended as a warning against being locked into programming a certain way *just because* of a certain structure. As the author mentions later, "Don't ever bend your program to fit the structure. Always arrange the structure to fit the program."

The end of Part 1 introduces the reader to a new way of writing and editing source code: using a word processor (in this case Apple Writer *II*e). As might be expected, this section is filled with helpful techniques on how best to go back and forth from the word processor to the assembler.

The Ripoff Modules

Part II of the book, the Ripoff Modules, is the most valuable section for the aspiring assembly programmer. Perhaps the best way to master any computer language is to study another person's program, take it apart, modify it, put it back together, and otherwise play around with it until the techniques of the original author become your own.

The Ripoff Modules provide you with the opportunity to do just that. The modules are a series of nine commonly needed routines coded entirely in assembly language. Besides being useful as standalone routines, they demonstrate how certain techniques are performed in assembly language.

For example, the indirect indexed addressing mode is clearly illustrated in module 1, the File Based Printer. The technique of using the stack to do sneaky jumps is demonstrated in the Option Picker, module 6. Other modules deal with the time delays, sound effects, music, and random numbers.

Along with his ever-present inside tips and hints, Mr. Lancaster includes with each module a box full of "Mind Benders." These Mind Benders are things to try or think about after you've gone through the module. As you might imagine, some of these do get quite mind bending.

Conclusion

This book would be most valuable to the reader who has just learned the basics of assembly language. It also would have much to offer for programmers in the intermediate stage. The book would even prove useful to that one *machine* language programmer (presumably in Siberia somewhere) who still hasn't learned how to use an assembler.

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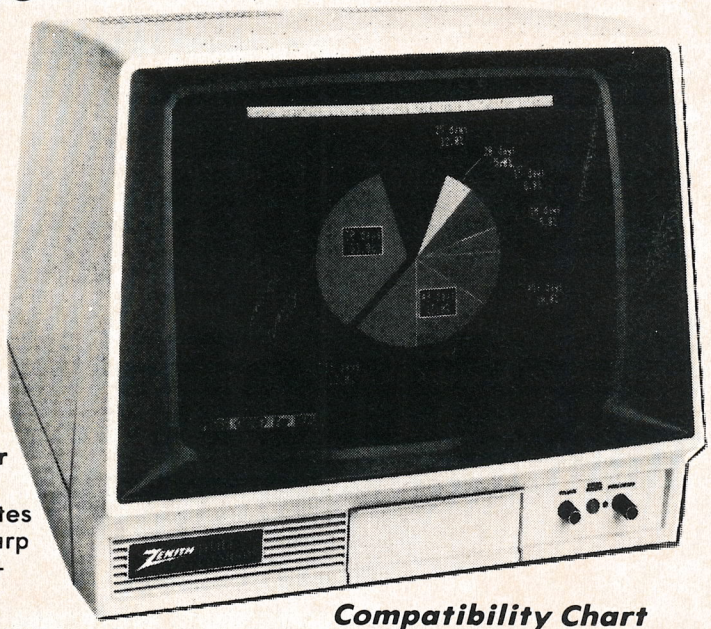

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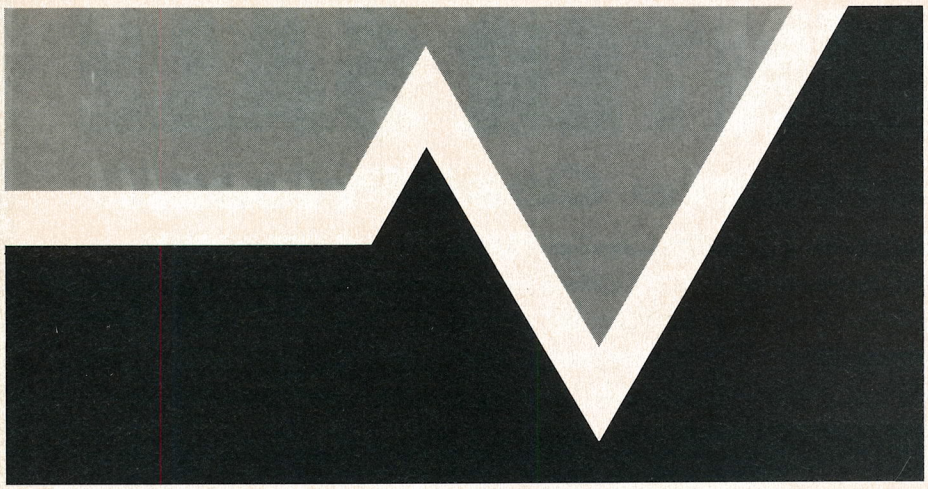

Bruce F. Field

MOUSEPAINT WITH THE EPSON

I have had a number of questions over the past months about how to use Apple's Mousepaint program with printers other than the Imagewriter. My solution, which is not very satisfactory, is to save the graphic picture to disk, exit Mousepaint, load the picture back in using a BLOAD command, and use a screen dump command to print it. Bob Gardner of E-Tech Services (P.O. Box 2061, Everett, WA 98203, phone (206) 337-2370) sent me a neat little program that he sells for the incredible price of $7.95. It modifies your copy of Mousepaint to work with Epson printers. Several options are available: single size, normal and inverse print. Once the new driver has been installed on your Mousepaint disk, you select "Print Picture" from the Mousepaint menu to print to the printer. I had a friend of mine look it over and he reported that the program is easy to install, takes about 5 minutes, and is all menu driven. He used it with a Grappler + interface and a n Epson RX-80 and it worked fine. He also tried it with a Pkaso interface and found it didn't work. Bob is looking into this problem.

MODIFYING A MASTER CATALOG PROGRAM

Last month I had a question about modifying a Master Catalog program for use with an Imagewriter printer rather than an Epson printer—some of the control codes had to be changed. Joan Dunham wrote to say she has already done all the work and it is available on Washington Apple Pi disk 154. She said she did have a problem with control characters imbedded in program names sending her printer berzerk, so this version replaces them with a blank space. Thanks, Joan.

KEEP SCROLLING

Ray Merlin dropped me a note about problems he had with a Hayes Micromodem II and a Grappler + interface card. "I recently bought an enhanced *//e* and transferred my cards over from my II+. I then tried a new terminal program with it and spent a week in various stages of frustration trying to get the printer to work. Just before throwing the whole thing out the window, I decided to try other interface cards on the selection menu. Lo and behold, I discovered that the menu had two Grappler selections, one "Grappler" and one "Grappler +." I made the proper selection, and instant success. When scrolling down a menu that comes up from the bottom, the Grappler appears first, and it is easy to stop and overlook the fact that Grappler + is yet to appear. I'm not saying that this is the problem that others are having, but it's worth mentioning."

STORE YOUR RESULTS IN COLUMN C

Q. *I have a problem with THE Spreadsheet. In a monthly sales model, I want to input the monthly sales figures for various products, but also automatically keep a year-to-date total. If under column 'A' I input new figures, and under column 'B' the YTD totals are kept, the formulas +A+B or even @SUM(. . .) do not work, since they recalculate several times. What am I doing wrong?*

A. As I understand your problem you are trying to sum columns A and B and store the result back in column B. As you see, this will not work because THE Spreadsheet will continuously recalculate. Instead, you will have to store the results in column 'C'. Thus your column 'B' will be one month old and column 'C' will contain the latest results. After adding the new figures, save column 'C' to disk as a DIF file (use the Save menu) and then before changing the data for the next month load the DIF file back into column 'B'. The DIF file only transfers values, not formulas, so no recalculation will take place.

ANYONE HAVE A SOLUTION?

Q. *Also on THE Spreadsheet, if I want to copy a cell under the condition that a certain cell is not '0' I can use @IF(0,. . . .), which work with values only, but not with labels. How can I copy a word (or name) if the condition applies, or am I asking for the impossible?*

A. As you note, the IF command only works with values, not labels. I don't know of any way around this. Perhaps an enterprising reader has a work-around solution.

EAT THE SWORDFISH

Q. *How do you get by the statue in Pixel's Revenge?*

A. I've had a lot of trouble with this one, so I asked Ron Wartow, our authority on gaming, for a little help. His response was "eat the swordfish then hold the bones over your head and say the word "crackerjack." I haven't tried this but when it comes to swordfish, Ron knows his onions.

MEMORY CAPABILITIES AND APPLE'S CPU

Q. *How about a brief tutorial on the relationship between memory capabilities and the Apple's central processing unit? It's my understanding that the 6502/65C02 processor is limited to 64K in terms of random access memory that it can directly address. Yet, Apple developed a system called "bank switching" that provided an extra 64K. Why are 8-bit processors limited to 64K or direct-address-memory, and how does the bank switching get around this limitation?*

A. At the risk of being slightly incorrect technically (there are always exceptions), let me see if I can explain how it works. The processor in the Apple II (6502 or 65C02) has 16 pins used for addressing memory and input/output devices. If you consider that each pin may be "on" or "off" (high voltage or low voltage), there are 65536 possible combinations. A "K" is defined as 1024 things, so 65536 is 64K things. The memory in the Apple is arranged so that it can be accessed by bytes, thus we can choose one of 64K bytes of memory using our 16 pins. Now visualize two boxes connected together by 16 wires. The box on the left is the 6502 and the box on the right is memory. Suppose we did a sneaky thing and replaced the box on the right with another box containing different memory? The processor could now use this memory,

but not the old. Remember, I said before that the 16 pins are used for addressing input/output devices as well as memory. One of these "devices" is a switch. Reading or writing to a particular memory address causes the switch to change position and the switch controls which box (or "bank") of memory is connected to the processor. So, although we have 128K of memory, only 64K can be used at any one time. However, it only takes a few microseconds to change the switch from one setting to another.

You can see then that it is possible to have many banks of memory around and switch in whichever one is needed. The problem is just a little more complicated. If you are running a program that is in one bank and you switch to another bank that doesn't contain a copy of the program, the processor thinks the program just disappeared and will probably go into never-never land. To prevent this, the designers set up the controls to switch only pieces of the memory at one time rather than the whole thing. This is one problem with plug-in memory cards for the Apple, except the 64K cards for the //e . The memory cards contain the circuitry to do the bank switching and not all manufacturers do it the same way. The circuitry for the //e 64K card is on the Apple motherboard so those cards are compatible with one another.

There is no inherent reason why 8-bit processors like the 6502 etc. can address on-

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Clock Dating

Automatic date stamping of disk files is set up for 6 kinds of clocks or Hello manual date entry. New DATE command will auto-insert date in correspondence.

All times in seconds. (Time Test programs available)		DAVID DOS-II	ProDOS	DOS 3.3
TEXTFILES (100 Sectors)	TSAVE	8.0	NO	NO
	TLOAD	6.2	NO	NO
(791 Strings,	WRITE	29.3	28.0	88.4
32 chars ea)	READ	24.3	16.3	83.8
	PRINT/READ	44.2	45.9	117.1
(442 Sectors, 7 x 500)	APPEND	142.3	142.9	1231.2
APPLESOFT (100 Sectors)	*SAVE	6.4	16.4	33.1
	LOAD	5.0	4.0	23.5
INTEGER (100 Sectors)	*SAVE	6.6	NO	33.4
	LOAD	4.9	NO	23.4
BINARY (100 Sectors)	*BSAVE	7.3	18.4	28.7
	BLOAD	5.8	4.8	24.5
48K PROGRAM SPACE	APPLESOFT	36,352	NO	36,352
(With 3 Bufs avail)	INTEGER	36,352	NO	36,352
	BINARY	36,352	34,816	36,352
64K PROGRAM SPACE	APPLESOFT	46,592	32,256	35,756
(With 4 Bufs avail)	INTEGER	46,592	NO	35,756
	BINARY	46,592	41,728	35,756

*Add 5 seconds for Verify. Apple II, Applesoft & ProDOS are trademarks of Apple

Ten New DOS Commands

1. HIDOS moves DOS above 48K memory.
2. FRE makes ultra-fast garbage collection.
3. DATE stamp files. Clock or manual dating.
4. TLOAD speed loads all Text Files to mem.
5. TSAVE speed saves Text Files from memory.
6. TLIST lists all Text Files to screen/printer.
7. DUMP Binary/Ascii to screen or printer.
8. DISA disassembles Binary to screen/printer.
9. AL prints program Address & Length.
10. / is a one keystroke Catalog.

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ly 64K, except that when these processors were designed the designers thought 64K was more than enough memory for anybody. Newer 16-bit chips can address up to 16 megabytes, and someone ten years from now will probably wonder why they don't address more.

CHANGING A PROGRAM ON THE FLY

Q. *In Integer BASIC you could put a line in a program which modified a line in the same program when it was run. Along the lines of PRINT "10110 M$ = A$." Is there a way to do this in Applesoft?*

A. One quick way to change a program on the fly would be to do

```
PRINT CHR$(4)'EXEC MODIFIER'
```

where the text file MODIFIER contains Applesoft instructions with line numbers. There are a couple of problems with this method, after the new lines are EXECed into the program, Applesoft returns to the command mode, i.e. the program stops running. One way around this is to make the last line in the text file "RUN" or "RUN linenumber." The second problem is that all your previously defined variables are set back to zero.

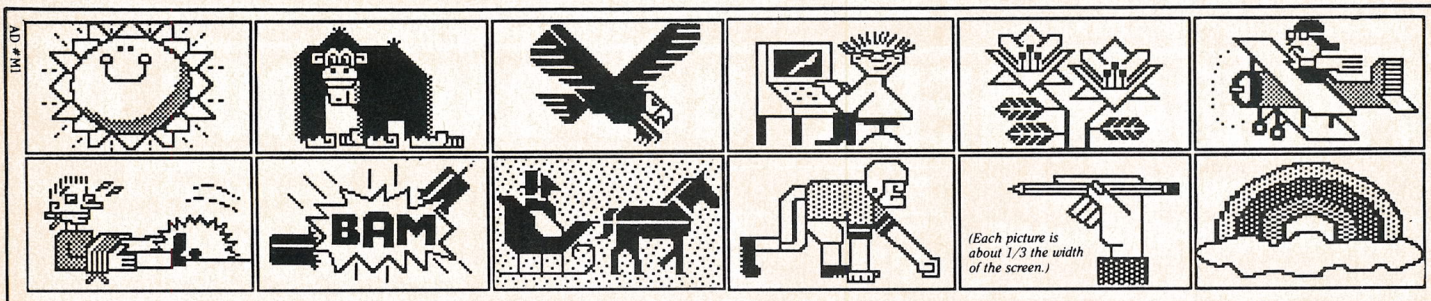
If you only need a few lines changed and can enter them from the keyboard, Cornelis Bongers had an article in the September 1982 issue of *Call -A.P.P.L.E.* with code that allows you to input executable Applesoft lines as string input at run time.

HIDING THE ANSWERS

Q. *I am writing a testing program for my students using Applesoft and need a way to protect it from being listed. Is there a way to do this?*

A. There are a couple levels of protection you can provide, and since they would prevent most people from ever "getting at" the program they ought to hold back teenagers for at least 15 minutes. Memory location 214 is a parameter that can make Applesoft treat all commands typed from the keyboard as RUN commands. If you try to LIST the program, it runs instead. To use this, make the program you want to protect your HELLO (or greeting) program, and put the statement POKE 214,128 at the beginning. Whenever the disk is booted, the program will be run and then no Applesoft commands can be executed. The problem with this is that if you boot the computer with another disk, you can then load and list the "protected" program if you are careful not to run it fast.

To add another level of protection, you can move the disk directory from its normal location on a DOS 3.3 diskette to another track. This is a somewhat more complicated procedure and requires the use of a Disk Zap program that can read and write individual sectors to the disk. One location inside DOS, $AC01, controls which track contains the directory on the disk. You need to change this location from its normal value of 17 ($11) to a different value say 16 ($10) and then initialize a new diskette with the modified DOS. Now you must modify track 16, sector 0 on this new diskette; the second byte should be changed from $11 to a new value of $10. You must also set the track bit map to indicate that track 16 is used. Change bytes $78 and $79 of the same sector from $FF to 0. Now save the revised sector back to disk. To copy a program to the new diskette, set $AC01 back to $11 (POKE 44033,17), load the program from a standard diskette, change $AC01 to $10 (POKE 44033,16) and save it to the new diskette. You will be able to boot this new disk and load and run your programs, but you will not be able to copy them individually to another disk unless you know "THE SECRET". Combined with the location 214 technique above, this provides a moderate amount of protection against listing the programs, but still allows the disk to be copied using the standard Apple COPYA program.



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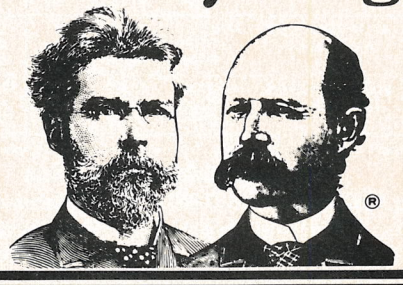

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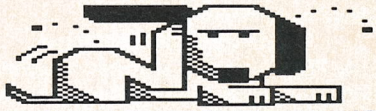

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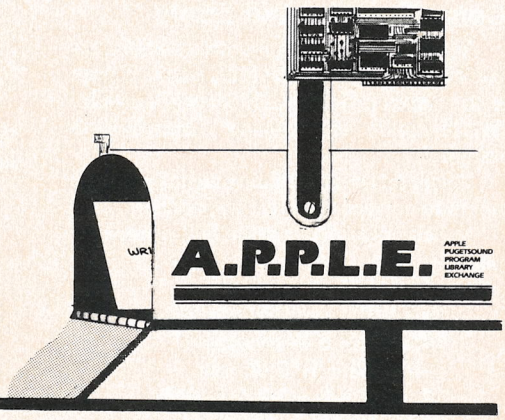

Readers' forum

Some New Errors

First let me thank you for producing a publication that I find invaluable in my chosen career as a programmer. I have been able to learn something new from each and every issue.

I write to you with reference to the article that appeared in the November 1985 issue entitled "Date Computer" and written by Cecil Fretwell.

By now I suppose you have had numerous people inquiring about the .LI0 .PM0 that appears just above the formula in the third paragraph. My guess is that they are word processing commands.

The second listing in the article has two errors which seem to be due to the incorrect typesetting. In line 200 a ')' appears to be missing from between the first 'INT' and the first '('. Lines 270 to 310 all appear with 'R = 2' when in fact they should be as follows:

```
270 IF R = 3 THEN...
280 IF R = 4 THEN...
290 IF R = 5 THEN...
300 IF R = 6 THEN...
310 IF R = 0 THEN...
```

As an experienced programmer it was easy to spot these errors, but I can well imagine the frustration experienced by the novice (I was a novice once) when he/she tries to run the program and does not get the expected result.

This one is for Cecil. I was able to get the same result using the following Applesoft translation of the formula using the example of Y = 1985, M = 6 and D = 11:

```
N = D + 2 * M +
INT(3*(M + 1)/5) + Y + INT(Y/4) -
INT(Y/100) + INT(Y/400) + 2
```

Is there a specific reason for not using this coding of the formula or is it just a case of programming style?

Russel S.J. Goodman

The author responds:

Dear Russel:

In general you are correct about the errors you referred to. Regarding your comments for the second listing, you missed the fact that Line 190 has a missing > , i.e., it should read

```
190 IF M > 2 THEN 220
```

You commented about some missing parentheses in Line 200, I think you meant Line 220. You noticed an error I did not catch. the (M + 1) should read ((M + 1).

You suggested an alternative formula for calculating the date. My code shows

```
N = D + 2*M + INT((M + 1)*6/10 + .05)
+ Y + INT(Y/4 + .05) - INT(Y/100 + .005)
+ INT(Y/400 + .005) + 2
```

First of all 6/10 is the same as 3/5. There is a good reason why I included the .05 or .005 inside the argument for the INT functions. Without them one could obtain something like 3.9999 whose integer part is 3 when in reality, the integer part should be 4. All digital computers are finite machines and can not always represent numbers exactly as the result of operations like multiply and especially divide.

Believe me when I say that based on experience, your coding will result in a wrong result due to something like 3.9999 instead of 4. I have often used this formula to support programs I have written for my wife who is a genealogist. I first coded the formula as you suggested,then later on had her

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discover I was producing improper results.

Again thanks for your comments. They are greatly appreciated. Do not hesitate to keep us all honest.

Cecil Fretwell

Corrections for Old Errors

While looking up some information in a back issue of *Call-A.P.P.L.E.*, I came across some errors in John K. Elberfield's article, 'WAIT-ing In The Monitor" (March 1983 issue).

As far as I could tell, no one has yet written in to correct these errors, and so . . .

the errors all occur in the first column on page 76:

A(A-1)/2 should be **A(A + 1)/2,**
1/2 A(A-1)*5 -A should be
1/2 A(A + 1)*5 -A, and
14 + 12A-1 + 1/2 A(A-1)*5
should be **14 + 12A-1 +**
1/2 A(A + 1)*5-A.

Hope this clears up any confusion.

Michael Ching

Thanks for the Review

Just wanted to thank you for the wonderful review of "Willy Byte in the Digital Dimension" (December 85 issue), specifically the section concerning the Mockingboard. We were pleasantly surprised when we first received a copy of this game, and feel that it stands as a shining example of the contribution Mockingboard can make to software products for the Apple II family.

We concur that Data Trek has done a commendable job utilizing the Mockingboard C. This was probably the result of incorporating Mockingboard support early in the product's development cycle. We will be watching this publisher's future releases with interest, and we hope other software developers take note of this product's use of the Mockingboard.

Michael S. LePage
Developer Support
Sweet Micro Systems

Educational Bargains

Your readers should know they don't have to pay $39.95 for good educational software. In looking around, I've found some terrific products that you've never reviewed and are not only very educational (I should know, having taught for 20 years!) but outstanding bargains. I bought a terrific program named "Game Power For Phonics" from an educator named Cecil Albert – why didn't I read about it in your magazine? Recently I read about a program called "Elf ABC." I contacted the company, Elfware, and purchased three programs (Elf ABC, Games and Coloring Book) for $17.50 each. These are wonderful programs and are an incredible value.

While I like your magazine, I don't think you are doing your job very well. I think you should be looking for products that are superior products for the price. Many people have computers, but not a resource of money for software.

There are some good products "out there" that cost less than $40.00 each. Let's hear about them!

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[The writer's point about the need for quality software at reasonable prices is well taken. As most members know, A.P.P.L.E. Co-op is constantly searching for good software values and welcomes any suggestions you may have. In fact, one of the programs mentioned above, "Elf ABC," has been available through the Co-op's 1985 catalogs at a discount price. – Ed.]

Vertical and Horizontal from AppleWorks

When I purchased my Dynax Dx-15 printer (by Brother) from Printerland in Chicago, they told me there was no way to program the vertical and horizontal movements (VMI and HMI) from AppleWorks.

After a lot of fooling around and a year later, I finally figured it out. Here is how I did it with AppleWorks Version 1.2 and a Practical Peripherals PRinterface card. This information might be useful to AppleWorks users and might apply to other types of printers.

1. Interface Card Set-up: **Control-I K Control-I N.**
   (This kills the line feed from the card and sets the line length to zero.)
2. 6 Lines/inch: **Control-I Control-Z Escape Control- M Control-I Control-Z Control-I.**
   (Normally, Control-I is interpreted as a card control character and not passed on to the printer. The "Control-I Control-Z" sequence tells the parallel card to change the card

control character from Control-I to something else and lets the Control-I through to the printer. "Control-Z Control-I" resets Control-I as a card control character.)

3. 8 Lines/inch: **Control-I B Escape Control- M Control-G.** (The "Control-I B" tells the PRinterface parallel card to let the Control-G character through to the printer.)
4. 10 Characters/inch: **Escape Control-_Return.**
5. 12 Characters/inch: **Escape Control-_Control K.**
6. 15 Characters/inch: **Control-I Control-Z Escape Control-_Control-I Control-Z Control-I.** (See # 2 for sequence explanation.)

The point is that when AppleWorks asks you to type in your printer set-up codes, it expects you to type the ASCII characters, not the actual numbers. AppleWorks then sends them to the printer as hexadecimal values of the ASCII characters typed on the set-up screen. The Dynax manual gives hex and decimal equivalents for printer set-ups, but not the ASCII equivalnts. Also, Control-I sequences jazz-up most printer interface cards because Control-I is usually used for card formatting and contol. You have to temporarily change the Control-I character to something else. As most users are not "hackers," this would be helpful to know.

David Norman

Is There A ProDOS Driver for Corona?

I am writing to solicit your assistance. I own a Corona Starfire 10 Megabyte hard disk drive. I am using it with an enhanced Apple *//e* and Titan Accelerator *//e* among other boards. The Corona is compatible with DOS 3.3, Pascal and CP/M.

Corona sold its Apple hard disk technology to Rana Systems and no longer supports the Starfire. Rana Systems has gone out of business. I now find myself with no one to turn to for help. I wish to use the Starfire with the ProDOS operating system. I would like to know if anyone has a copy of the ProDOS driver for the Corona or Rana hard disk drive which I could purchase. Or, if there is someone who could write a driver for me.

I would appreciate any assistance you or your readers may offer. Thank you in advance.

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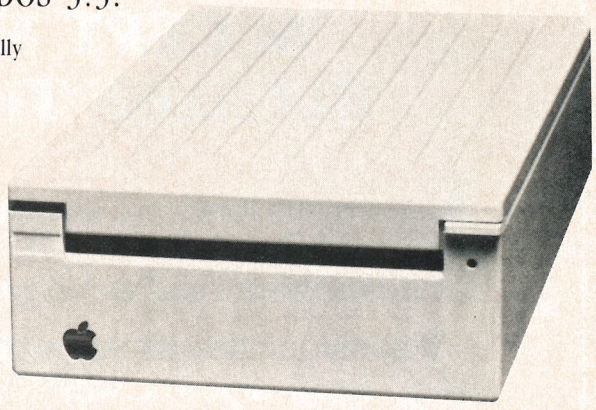

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WORD SEARCH PUZZLES—are both fun and educational for vocabulary and spelling. Our word search puzzle allows you to create puzzles with up to 40 words, choice of 20 by 20 or 20 by 40 character puzzle size and gives you the option of printing the answer key or not (great for making puzzles for yourself). Only $25 postpaid for the Apple II+, e, c. C. Blish, P.O. Box 2131, Littleton, CO 80161, (303) 796-0341.

ELECTRONIC DRAFTKIT—Hi-res drawing program for the Apple II+, *IIe*, and *IIc*. For drawing electronic circuit schematics, printed circuit board layouts, architectural drawings, etc. 48 shapes and 2 font tables in memory at once. Work area is 2 ⅔ screens large. Rough/fine move, rough/fine four way scroll, draw/erase/rotate, plot/erase lines, type on draftboard (all ASCII characters: rotate, erase, inverse print). Fully menu driven (main, plot mode, typing mode, and DOS menus in memory and instantly available). Save/load/print pictures, change fonts. Main program in machine language, screen dump commands in BASIC, source code for several total picture dump routines provided (Epson, NEC printers—Grappler, Microtek, Apricorn interface cards). $28(S & H included). R.J. Rowley, 1212 E. Del Rio Dr., Tempe, AZ, 85282.

BRAND NAME SOFTWARE CLOSEOUT—Apple II, *IIe*, *IIc* brand name software. All titles over 50% off list. Over $10,000.00 worth of software below distributors prices. Don't miss this closeout sale! Call/Write for a complete list. NEXO DISTRIBUTION, 8824 Golf Drive, Spring Valley, CA 92077 (619) 589-7928.

APPLE PERIPHERALS FACTORY DIRECT—*IIe* 64K/80 Column Board $39. Joystick II, *IIe*, *IIc* (specify) $14.95. Quad-port, multiple game I/O, II, *IIe* $14.95. Mouse w/Software II, *IIe* $49. TV Modulator w/sound $10.95. Cooling Fan w/surge protect $24.95. QUANTITY DISCOUNT! 1/yr warranty all products. Write or phone for complete illustrated price list. Add $2.50 shipping per order. COD add $2.50 extra. NEXO DISTRIBUTION 8824 Golf Drive. Spring Valley, CA 92077 (619) 589-7928.

PASCAL SOFTWARE TOOLS & WORD PROCESSING—Software Tools 1 is a set of procedures and functions to support fool-proof forms I/O, data entry editing, validity checking, text screen dump, and much, much more. Proscribe is a text formatter program that can be used in conjunction with your Pascal editor to create a professional word processing system. It includes advanced features such as dynamic space allocation for figures and tables, full printer command support, file linking, etc. This software is unlocked and unprotected. It includes commented source code and complete documentation on disk, and is compatible with Apple II, II+, *IIe*, *IIc* computers with Apple Pascal Version 1.1 or 1.2. $19.95 postpaid for Software Tools 1. $24.95 postpaid for Proscribe. Write to: PROSOFT, 137 Covington Drive, Benbrook, TX 76126. Texans please add sales tax.

RB5X ROBOT WITH 32K—Voice synthesis, Savvy Pro System, Proms, Apple interface. New condition, $2300 includes shipping and all documentation. Doug Ford, Comp. Sci. Dept., Saint Martin's College, Lacey, WA 98503.

BANNER PROGRAM—lets your printer create banners for open houses, parties, meetings, etc. You have the choice of standard, Roman, Large, Computer or Greek fonts and can select letter size from 1 inch to over 12 inches tall (depending on your printer width). $25 postpaid for the Apple II+, e, c. C. Blish, P.O. Box 2131, Littleton, CO 80161, (303) 796-0341.

PLOTTER SOFTWARE—Presentation aides (word charts) are quick and easy to prepare using the DGI SIGNMAKER. With the DGI SIGNMAKER, your Apple II+, e, c and plotter (APPLE, HP, HI, Epson) your overheads, text slides or signs will have that professional look. $75. For additional information, ordering or to check compatibility contact: Decision Graphics, Inc., P.O. Box 2776, Littleton, CO 80161 (303) 796-0341.

EXTRA INCOME—Turn your interest in computers into extra income by visiting your local computer stores once every 2-3 weeks. For information, write: SoftRack, 2600 Keslinger, Geneva, IL 60134 (312) 232-0711.

APPLE GRAPHICS AS EASY AS ABC—Write for free airmailed 12-page instructions from Pasir Panjang P.O. Box 74, Singapore 9111. Republic of Singapore.

FOR SALE—Apple II+ 64K, 2DD, RGB Color Monitor, Stand $1,000 (206) 784-2081.

CRAKNIQUES—Learn how the experts crack the top programs on the market. Teaches you how to crack any program. Is not a "cookbook" like Crakig Techniques and HardCore. Comes with sample disks to practice cracking. Send $20 to: Matt Haines, 215 N. terrace, Wichita, KS 67208 (316) 683-7419.

WANTED—for community college. Apple *IIe* computers. Donations are tax deductible. Call Ron Distefano (215) 837-7136, Bethlehem, PA.

INTERNATIONAL COMPATIBLES—Supporting II+, Franklin, & all compatible userrs, with a monthly newsletter, public domain library, on-line services and personal attention. Membership $20 a year. Info SASE. Franklin Users Group International, 65 East Wind, Tecumseh, MO 65760, Modem (417) 869-5294.

40TRACK DRIVES—Most 5 ¼" drives can handle 40 tracks. Information and software available for DOS 3.3 and PCPI CP/M. $17.00. Franklin Users Group International, 65 East Wind, Tecumseh, MO 65760, Modem (417) 869-5294.

CP/M SIDEKICK—Write-Hand-Man a Sidekick-like utility for CP/M 3.3 (PCPI and Softcard). Provides Calculator, Calendar, Phonebook, Notepad, and Communications. Only $49.95 plus $2 S&H. FUGI, 65 East Wind, Tecumseh, MO 65760, Modem (417) 869-5294.

SPEED-UP HOME ACCOUNTANT—Speed up file processing 4-60 times, search 100 times faster, load report program in 40 vs 240 sec., go directly from program to program, PLUS MORE. The 64K version supports harddisks, ramdisks, 120 categories, prints reports on 80 column card, etc. VISA/MC Accepted. Satisfaction Guaranteed. DOS 3.3 Version only. $19(48K), $24(64K) Plus $2.50 Shipping/handling: SOFTWARE SOLUTIONS, 5516 Merritt Circle, Edina, MN 55436. For Orders only 1-800-835-2246 Ext. 131.

GRAPHICS—for your Apple II+, *IIe*, *IIc*. This program will collect them on disk from games, etc. Hi-res, both pages. Save or Load in 4 sec, invert, combine for montage. AppleWorks type menu. Supports Grappler directly or use your own print dump software. IMAGE JUGGLER. Also available: WRITE STYLE for your IMAGEWRITER and APPLE DMP. Bold, condensed, enlarged, proportional, slashed zeros, and unidirectional at a keypress. In & out in less than 1 min. sets up printer for any printing job. Any Apple II. OUR POLICY: TRY BEFORE YOU BUY. Send only $5.00 per program. This pays for shipping & materials. Then, if you like our programs, make it legal by sending $20 for each program desired. Manuals and validation stickers will follow. Otherwise we trust you to erase disk. Green Mountain Software, Dept. A, P.O. Box 40853, Portland, OR 97240.

MISCELLANEOUS FOR SALE—20 Megabyte CORVUS Hard Disk, Mirror Backup, Custom Desk and VCR, $1300; 128K Apple *IIe*, Disk Drive, Color and B&W Monitors, $800; 512K Macintosh, Imagewriter, $1650; Malibu 200 15" Printer, Interface Card, $650; Arithmetic Co-Processor, Language support, $140; Mockingboard Speech/Sound Synthesizer with Thunderbombs and Microbe, $65; Eprom Burner/Eraser, $70; Word Handler, $20; Ascii Express (3.3), $35; Spreadsheet 2.0, $25; Little People Puzzles, $14. Tom Tosch, 16025 10th Ave. S.W., Seattle, WA 98166 (206) 246-3839.

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20 Epson FX/JX Fonts

DMP Utilities includes menu-driven software to download the character sets, and to eliminate printer control problems forever. You also get a character editor (full descender, proportional ability) and a program to convert some of the many hi-res character sets for printer use.

DMP Utilities is supplied on DOS 3.3, unlocked, and includes a 67 page User's Manual. Because the fonts are downloaded, they work with *any* program, not just AppleWorks. Our no-risk warranty provides you a full refund if you're not happy with the programs. The Utilities costs $50 (+$2 p/h). MC/Visa gladly accepted

DMP Utilities works *ONLY* with Apple DMP, Imagewriter I or II, and Epson FX or JX printers.

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THE MARKETPLACE

The following items are selected by our editorial staff from the large number of product announcements and news releases sent to us daily. They are presented solely to keep you informed about the current market for Apple related hardware and software. As we have not tested many of these products, appearance here does not necessarily represent endorsement or recommendation by A.P.P.L.E. Further information about items appearing in The Marketplace can be obtained through the Reader Service Card. If you contact any manufacturers directly, please mention that you learned about them in *Call-A.P.P.L.E.*

NEW, IMPROVED MACINTOSH AND LASERWRITER FROM APPLE

Apple Computer, Inc., announces the Macintosh Plus and the LaserWriter Plus. Highlights of the Mac Plus are 1 meg RAM, 800K disk drive, new keyboard with built-in numeric keypad and direction keys, and a SCSI interface. A new 128K ROM with an improved finder and hierarchical file structure along with disk cache are standard. The appearance of the unit is the same as the Macintosh including the 9 in. monochrome screen. Pricing is expected to be $2599.

Upgrades to present Mac owners for the new disk, ROM, and new motherboard are also announced. Expected prices are $299 for drive and ROM updates only. A complete upgrade of a 128K Macintosh to the Macintosh Plus will cost an additional $799 (or $599 for a 512K Mac). Apple also indicated that the present 512K unit will be produced "as long as a demand exists."

The LaserWriter Plus features 1.5 meg RAM and has 41 new typefaces available. Tentative price for the new unit is $6794. Upgrades are available for the current LaserWriter and are priced around $695. (Ed note: For complete details of these new units, the February *Mac A.P.P.L.E.* has it all.)

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A MULTIFUNCTION BOARD

Multicore is Quadram's multifunction board for Apple II, II +, and *IIe* systems. Multicore functions as a memory expansion board with a RAM disk that is totally devoted to the RAM drive. It can be configured in capacities of 64K, 128K or 256K.

The product is equipped to perform printer interface functions. It has a parallel port, permitting interface with printers such as Quadram's Quadjet ink jet printer and Epson dot matrix printers. It also has a serial port which permits use of Apple's Imagewriter and Scribe printers. A driver available through Quadram permits use of ASCII Express communications software.

Multicore is further equipped with a ProDOS compatible clock/calendar with long-life lithium battery for time and date stamping of files. Price: $219 for 0K, $279 for 64K, $329 for 128K and $399 for 256K. *Quadram, One Quad Way, Norcross, GA, 30093-2918, (404) 923-6666.*

Circle 45 on Reader Service Card

COMPRESSING PRODOS FILES

Signum Microsystems announces DOCUMAX, a text management program that offers Apple *IIe* and Apple *IIc* users the ability to perform full-text searches of standard ProDOS text files and to compress text to 50 percent of its original length.

The text management and retrieval component of DOCUMAX eases the organization of text files, allows quick inspection of the contents of text files with forward and backward scrolling, performs high speed full-text searches for any subject, automatically collects passages on any subject from existing files into a new file, cuts and pastes across files, and provides basic text editing. The text compression function both doubles the user's disk storage capacity and cuts in half the cost of transmitting text files over telecommunications lines. DOCUMAX is compatible with text files produced by virtually all ProDOS programs including word processors such as Apple Writer, and communications programs such as Apple's Access //. DOCUMAX is also directly compatible with AppleWorks word processor files.

DOCUMAX can search the full text of several files at a time with a rate of 50,000 words per minute, using AND, OR, and NOT logical relationships between arbitrary phrases. The search phrases can consist of any combination of letters, numbers, spaces, and punctuation. A special option is included that can overlook misspellings and which also can be used when the spelling of the phrase being searched (such as a person's name) is in question.

Users can also gather information automatically in context (with up to 19 lines of surrounding text) from any number of files into a single file. A source index is created automatically as the information is collected. DOCUMAX comes with functions for managing text. It can be used to break up files into text segment files with automatic indexing and to merge files into new documents. These text management functions give the user added flexibility in organizing reusable sections of text for later reference. They also provide the means to cut and paste across any number of files when creating new documents from a variety of sources.

An editor is included for modifying the existing text of files from various ProDOS programs. It also has sufficient capability to let the user create drafts of new documents from scratch and to move, copy, and erase large blocks of text within a file. Any file that is created or modified with DOCUMAX can be completed with the user's favorite word processing program.

An important and unique aspect of DOCUMAX is its ability to compress random-word-usage text by 50 percent and highly redundant text by much greater amounts. DOCUMAX compresses text at a rate of 50,000 words per minute and will recover the exact original document at about the same rate. For heavy users, text compression saves both storage and text transmission costs by a factor of two without any investment in new hardware. Moreover, DOCUMAX will read, print, search, cut and paste, and edit compressed files directly just as easily as standard files.

DOCUMAX comes with several file management functions such as directory sorting (alphabetical and chronological) and hierarchical directory management. Users can gain access to any directory within a hierarchical directory system without typing in path names. Users can also tag as many files as they wish for processing at one time from any directory. For example, users can batch delete, copy, compress, decompress, and print as many files as they want without ever typing in file names.

DOCUMAX is not copy protected and can be used on floppy disk or on Apple's ProFile storage device. Price: $99.95. *Signum Microsystems, 120 Mountain Avenue, Bloomfield, CT 06002, (203) 726-1911.*

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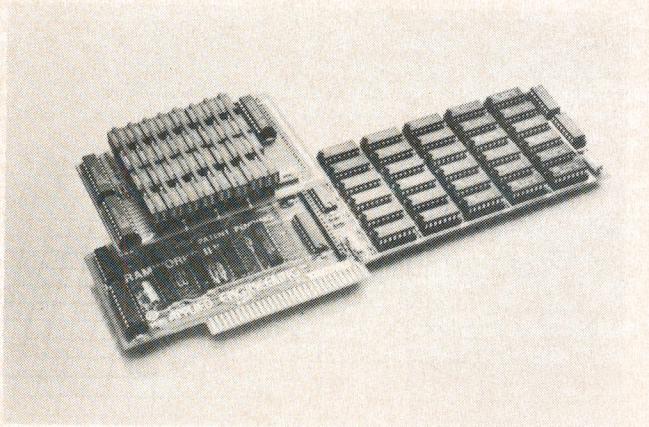
ADD MEGA MEMORY



Need more memory for your Apple? You can add three million bytes of additional RAM to your Apple *IIe* with a Ramworks II board from Applied Engineering of Dallas.

A piggyback board, less than half the size of Ramworks II main board, holds twice the amount of memory. The piggyback board contains 64 256K-bit dynamic RAM chips in small inline packages. The three-megabyte Ramworks II sells for $1699. A one-megabyte Ramworks II without the piggyback board is $389.

Ramworks II increases the size of the Apple *IIe* memory by 4140%, producing a "desktop" message that reads "2,277K avail." for users of Apple Works. In addition, Ramworks II provides users with a built-in 64K printer buffer which allows use of the Apple while long documents are being printed. *Applied Engineering, P.O. Box 798, Carrollton, TX 75006, (214) 241-6060.*

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SEATTLE AREA NEWS ON LINE

The Shuttle Corporation of Redmond, Washington has developed the SHUTTLE EXPRESS, a free electronic information service. The EXPRESS is packed with news, features and interactive services sponsored by local businesses. It is *absolutely free,* and can serve up to 48 callers simultaneously.

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TAXES AND APPLEWORKS

Users of AppleWorks who are familiar with the integrated applications program's capabilities may be interested in TAXWORKS, a package of templates that turns AppleWorks' spreadsheet into a comprehensive tax preparation program. TAXWORKS calculates 1985 federal income taxes, automatically makes multiple entries, and prints out tax schedules that can be filed directly with the Internal Revenue Service. The package also estimates the effect of federal tax reform on the taxpayer's tax bill.

TAXWORKS requires no knowledge beyond familiarity with AppleWorks' spreadsheet, but incorporates a mock-interactive tutorial to assist the user in making correct entries. Price: $19.95 + $2 shipping. *Personal Financial Services, P.O. Box 1401, Melville, NY 11747, (516) 261-8652.*

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For Your APPLE**

e-Z CARD

Uses Z80A CPU Needed for WORDSTAR, dBASE II**, MULTIPLAN** and runs all 2.2 CPM** PROGRAMS. We use all "LS" devices to save power and the card will execute full Z80 and 8080 instruction sets, including Z80 interrupting. Software not provided.** KIT: $55.00 READY TO USE: $80.00

128K CARD w/Built-in Disk

The ORBITAL 128K RAM CARD with a disk drive built-in, will expand the memory of your Apple*II, II+, IIe another 128K or can be used as a second disk drive. The ORBITAL 128K CARD emulates a disk drive but, not like the standard mechanical drives, the ORBITAL 128K CARD is ten times faster. It is faster because it fits inside the Apple* just like any other card and has no motor to turn on or off. KIT: $199.00 READY TO USE: $229.00

IIe** 64K 80 COL CARD

Expand your IIe with 80 COLUMNS and 64K MEMORY including double high resolution graphics on "B" motherboard**

KIT: $85.00 READY TO USE: $100.00

COPYCARD

The COPYCARD is capable of making archive copies of your copy-protected software, a must for game players. The COPYCARD converts a copy protected program into a non-copy protected program in a standard COPY A format, giving you the opportunity to correct the software to use non-supported hardware, Typical hardware changes are for 80 column cards, printer interfaces, and other I/O devices. NOTE, SYSTEM REQUIREMENTS: Apple* II, II+ require 16K RAM card and one disk drive with 3.3 DOS. WILL NOT WORK at this time with Apple* IIe computer. COPYCARD comes with utility software. KIT: $50.00 READY TO USE: $80.00

MasterCard VISA Accepted. AZ residents add 6% sales tax. SHIPPING CHARGES: ADD $1.74 per. UNIT C.O.D. ORDERS: $1.90 per ORDER

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RAMBO BACK IN NAM

John Rambo, former Vietnam hero, is assigned to go back to the war that, for him, was never over. He parachutes into the middle of enemy territory. The player's mission, as Rambo, is to prove the existence of American POW's in Vietnam—not to engage the enemy. The pentagon will supposedly bring the men home, but Rambo can't turn his back on fellow Americans suffering such torment.

Rambo is alone—with a beautiful woman, an AK-47 machine gun, a knife and a bow—to face the nightmare of Vietnam all over again. But this time he must win—or die! The player is put to the ultimate test.

Mindscape's RAMBO, for the Apple II or Macintosh, utilizes a full parser, a programming feature that allows the player to give commands in plain English. Characters in the adventure respond realistically, appearing at various locations and exhibiting different moods each time situations and events are presented. In addition, the player can take advantage of roving "vehicles" for transportation through the story environment. Price: $39.95. *Mindscape, Inc., 3444 Dundee Road, Northbrook, IL 60062, (312) 480-7667.*

Circle 50 on Reader Service Card

A CLEAN SCREEN

The Screen Data Corporation announces CRT Cleaner from Sweden which eliminates, cleans, and protects the screen from static electricity. It eliminates the need for drying the screen after cleaning. Since no special drying cloth is needed, AYA One-Step reduces the cost of each application to under 20 cents. Convenient foil sealed packets can be kept in their own theft-proof dispenser that attaches to the side of the terminal.

AYA One-Step also offers superior anti-static protection and the wipes contain an effective anti-static coating which dries on the screen. AYA Office Cleaning Wipes are handy for miscellaneous jobs like cleaning keyboards and terminal cases. Their anti-bacterial properties also make them an excellent choice for telephone mouthpieces. *Screen Data corporation, 80 South Jefferson Road, Whippany, NJ, 07981, 1-800-248-1212.*

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VF	Pak of 25	$20.00	$22.50
Assoc.	Case of 100	$70.00	$80.00
Brand	Carton of 500	$300.00	
	Carton of 1000	$550.00	

(Includes hub rings, white Tyvek sleeves, labels; thick sturdy diskettes, fully certified error free; surfaces of such high quality they retain data even from drives admitting signals 25% below normal strength!!!!)

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Disk Drive for II & IIe	$109.00
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II, IIe Interface	$49.00
IIc Hotlink	$55.00

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SEVERAL PROGRAMS IN ONE

Nite Owl Productions announces The Nite Owl Journal #1. This is the first in a series of products which combine several general purpose programs into a single package. The Journal features the *Home filing System,* a general purpose data base program for the home computerist. The filing system is ideal for mail lists. It is capable of handling most home filing requirements for any type of information which a user might want to store, sort, search, and print.

Also included in the first Journal is a *Fast Disk Copy* program for reliably making backup copies of non-copy-protected 5 1/4 inch diskettes. Duplicates can be produced 3-10 times faster than with Apple's COPYA or FILER programs.

Other programs in the Journal are a *Mail Label Writer* program for making mailing and return address labels and a talking greeting program. The product comes complete with an instruction manual and a separate "Sample Data Files' diskette. Price $29.95. *Nite Owl Productions, 5734 Lamar, Mission, KS 66202, (913) 362-9898.*

Circle 52 on Reader Service Card

VOICE MASTER FOR THE HANDICAPPED

Covox, Incorporated is developing enhanced software for its VOICE MASTER speech system for the special education market. The software routines will allow users to control lights, appliances and other electric devices through voice control. The system will utilize the wireles remote control modules currently available from BSR, Radio Shack and other manufacturers in conjunction with the Voice Master system module.

Plans are also being formulated to develop software for a VRK (voice recognition keyboard) which will allow users to dictate words and have the computer respond to them as if they were entered directly from the keyboard. The VOICE MASTER retails for $89.95. *Covox, Inc., 675-D Conger Street, Eugene, OR 97402, (503) 342-1271.*

Circle 53 on Reader Service Card

INVENTORY CONTROL

Manzanita Software Systems announces its fourth module of BusinessWorks, a business accounting package designed for use on Apple's new 3 1/2 inch disk drives with an Apple *IIe* or *IIc* computer. *Inventory Control* complements the previously-released General Ledger, Accounts Payable and System Manager modules.

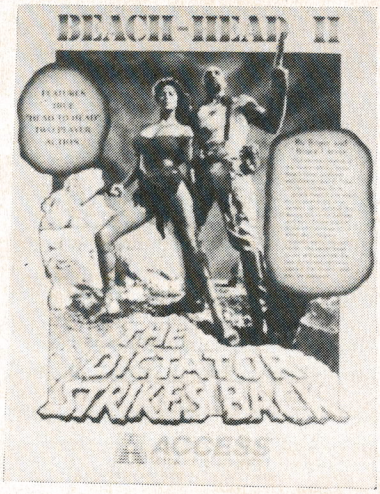
Inventory control can handle approximately 1,000 individual inventory items on the new 800K disk, or up to 10,000 items if the program is installed on a hard disk. Among the features of Inventory Control are the ability to track turnover, calculate gross profit margins, maintain multiple price levels, and handle fractional quantities. It also tracks purchase orders and generates open purchase order reports.

All of the BusinessWorks modules can be used together as an integrated system, or each module can be used separately. The only required module is the System Manager, which provides password security and a complete mailing label program.

BusinessWorks has been designed to look and act just like AppleWorks and information can be transferred to AppleWorks for use in data base and spreadsheet files. The System Manager retails for $95, the General Ledger and Accounts Payable retail for $395 each. *Manzanita software Systems, One SierraGate Plaza, Suite 200-A, Roseville, CA 95678, (916) 781-3880.*

Circle 54 on Reader Service Card

THE DICTATOR STRIKES BACK



BEACH-HEAD II is now available for Apples with a minimum of 48K of RAM. It is a fast-paced action/strategy game from Access Software and a sequel to the original game BEACH-HEAD.

Live-action video footage provides realistic animation of characters. Rotoscopic animation techniques, widely used in producing cartoons, were utilized to translate the live-action scenes into machine-language code for the game, frame-by-frame.

BEACH-HEAD II also features true head-to-head action for two players or one player against a computer-controlled opponent. It has multiple playfields, scrolling playscreens, hi-res graphics, various difficulty levels, and a "practice" mode. A provision is also included for recording the top ten high scores of both the offensive and defensive players to disk. Price: $34.95. *Access Software, Inc., 2561 South 1560 West, Woods Cross, UT 84087, (801) 298-9077.* Circle 55 on Reader Service Card

MIDI RECORDING SOFTWARE and POLYWRITER MUSIC PRINTING SOFTWARE

Half Moon Bay, CA — Passport Designs, Inc. manufacturer of the industry standard MIDI Interface and complete library of MIDI Software, introduces two new advanced programs for MIDI. MIDI/4 PLUS and MIDI/8 are the newest additions to Passport's extensive collection of MIDI Music Software. Both the four and eight channel recording programs feature auto-correct, punch in/out, fast forward/rewind, sequence chaining, and sync to tape, MIDI and drum machines. Both programs come on 5¼" floppy diskettes with easy-to-read users manuals for the Apple II+ and IIe computers.

The *auto-correct* feature in MIDI/4 plus and MIDI/8 perfects every performance rhythmically down to 32nd note triplets. *Punch in* and *Punch out* allow accurate editing to take place anywhere in the piece without re-recording previously entered parts. *Single step playback* facilitates punching in and out by allowing the musician to edit each beat in 24 increments. *Fast forward* and *rewind* make traveling through the piece fast and easy.

MIDI/4 PLUS and MIDI/8 still incorporate the original MIDI/4's multi-track tape recorder qualities with unlimited overdubs, real-time editing, tempo control, and accurate recording of all controllers including key velocity, pitch bend, preset changes, aftertouch, modulation, and more. With the addition of our Polywriter printing software and the Polywriter Utilities program, musicians can have an integrated recording, editing and printing system for MIDI at an affordable price.

Passport has expanded its popular POLYWRITER Music Printing System to include two more printing packages for MIDI. LEADSHEETER, an inexpensive alternative to POLYWRITER, prints out sheet music in Treble Clef/Piano score format. Like POLYWRITER, LEADSHEETER also accurately handles note division, seconds, accidentals, ties, 8vas, flags and beams, rests, any time and key signature, lyrics, and has full capability to edit and change the music once its notated.

POLYWRITER UTILITIES converts the Polywriter and LEADSHEETER music graphic files into the MIDI/4, MIDI/4 PLUS and MIDI/8 sequencer files. POLYWRITER UTILITIES also lets you print out MIDI/4 sequences in standard music notation. This combination permits full step editing and input of musical performances. And, the utilities program upgrades POLYWRITER and LEADSHEETER to except external clock sync data from other MIDI systems.

The equipment required to use POLYWRITER UTILITIES and LEADSHEETER are an Apple II+ or IIe computer with 1 disk drive, any MIDI keyboard, the Passport MIDI Interface, and a dot matrix printer with graphics interface. The POLYWRITER UTILITIES program retails for $79.95 and LEADSHEETER retails for $99.95. Both programs are available in music stores everywhere. Circle 56 on Reader Service Card

TAX PLANNING AND PROJECTION

EZWare Corporation introduces a new version of its professional tax planner that will allow individuals to develop a comprehensive present and future tax plan. It facilitates users of Multiplan, Lotus 1-2-3, and Excel, and is designed to allow individuals to develop the best tax strategy in the least amount of time, make tax planning decisions, and pay the lowest tax legally allowed. It computes present and future individual returns, parallels Form 1040 and related schedules, and allows all income adjustments, deductions, and credits to be entered and projected. EZTax-PLAN can be use with the Apple *IIe*, *IIc* and Macintosh computers.

EZTax-PLAN includes both current law and proposed tax reforms to allow easy evaluation of the effects of the President's tax program, projected up to 45 years (with available memory). The templates compute income tax, alternative minimum tax, self-employment tax, and tax under income averaging, investment tax credit, rehabilitation credit, credit for the elderly, and credit for a married couple. All of these are computed simultaneously under both current law and the President's proposals. Price: $95. *EZWare Corporation, 29 Bala Avenue, Bala Cynwyd, PA 19004, (215) 667-4064.* Circle 57 on Reader Service Card

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HELP FOR THE YOUNG

Learning Technologies, Inc., introduces ten new software titles. They are presented in three series (Early Learning, Thinking Strategies, and Math Concepts) and are compatible with the Apple II series.

The new titles in the Early Learning Series are

- ANIMAL HOTEL: Develops specific recall, visual memory, visual discrimination, and analysis of the whole.
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The individual titles in the Thinking Strategies Series include:

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- PIPELINE: Develops thinking skills such as defining a problem, experimenting with possible solutions, evaluating outcomes, recognizing patterns and determining part-whole relationships.

The first product to be released in the Math Concept Series is:

- MATH IN A NUTSHELL: Develops skills in counting, addition, subtraction, multiplication and division of single digit numbers.

The suggested retail price for each program is $19.95. The purchaser receives a Learning Kit which consists of five coordinated teaching aids. *Learning Technologies, 4255 LBJ, Suite 265, Dallas, TX 75244, (214) 385-2351.* Circle 58 on Reader Service Card

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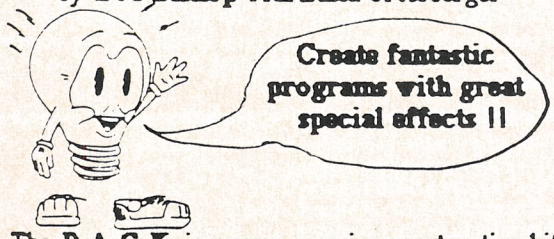
(Programmer's Assembly-language Construction Kit)

by Bob Bishop with Lucia Grossberger



The P.A.C.K. is a programming construction kit that gives you a multitude of building blocks (subroutine modules) and the utilities (the Editor, Assembler, and Linking Loader) to put these blocks together to build or add to your own programs. The P.A.C.K. also provides tools for creating your own subroutine library.

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CONTROL YOUR HOME

X-10 Inc., announces X-10 Powerhouse, a peripheral system that permits pre-programmed or instantaneous remote control over lights and appliances throughout a home or office. This Apple *II*c, *II*e product is compatible with the company's other home control products, which offer a wide range of security, convenience, and energy-saving benefits.

The X-10 product line includes plug-in modules, light switches, and wall outlets (all operable by remote control), timers and controllers, burglar alarm interfaces, and other products. X-10 Powerhouse is designed for use with all these products.

The peripheral system package contains a programmable interface/controller unit, software on diskette, and a cable to link the computer and the controller. The controller unit is self-powered and made to be disconnected from the computer after programming.

X-10 Powerhouse software employs color graphics and simple icons to speed set-up of the control system. It permits full 7-day, 24-hour programming, so that day-to-day schedules can be, but need not be, different. In addition to programming instructions into the controller, the software also permits instantaneous remote control of lamps and appliances directly from the computer keyboard.

The Powerhouse controller, which is plugged into a wall outlet, works by sending signals over the regular home AC wiring to X-10 remote control modules anywhere in the home. It requires no additional home wiring and is quickly installed by homeowners. Lamps and appliances, plugged into control modules (which are plugged into wall outlets), are controlled by Powerhouse signals. The console has rocker switches which provide instant manual ON-OFF control of eight lights or appliances, whether or not the computer is connected to the unit.

For more information contact: *X-10 Inc., 185 LeGrand Ave., Northvale, NJ 07647, (212) 986-6668.* Circle 59 on Reader Service Card

ENHANCED BASIC TO PASCAL TRANSLATION

Woodchuck Industries announces the enhanced P-TRAL, Version 1.0, a BASIC to Pascal translation software. It is a user friendly translator that enables the programmer to convert any of his Applesoft BASIC programs to Apple Pascal. P-TRAL reads the BASIC source program from disk and generates the equivalent Pascal source code. The program is disk based and is capable of translating commercial applications. Full documentation is included plus a demonstration run of the program.

P-TRAL contains internal enhancements including improvement to memory handling, and is now capable of translating even larger programs. System Requirements: Apple II, II+, *II*e, *II*c, 64/128K memory, 80 column display, 2 disk drives (hard disk recommended, not essential), Apple DOS 3.3./Apple Pascal 1.1, 1.2, 1.3. The price for Version 1.0 is $179. There is also an upgrade charge of $25 for current users of P-TRAL, which includes the revised manual.*Woodchuck Industries, Inc., 340 West 17th Street (#2B), New York, NY 10011, (212) 924-0576.* Circle 60 on Reader Service Card

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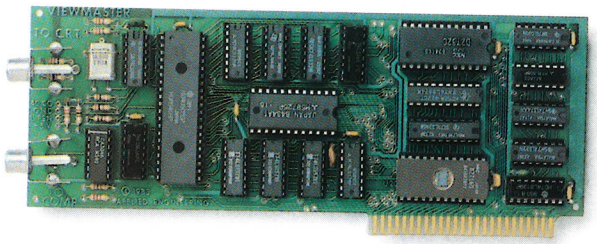

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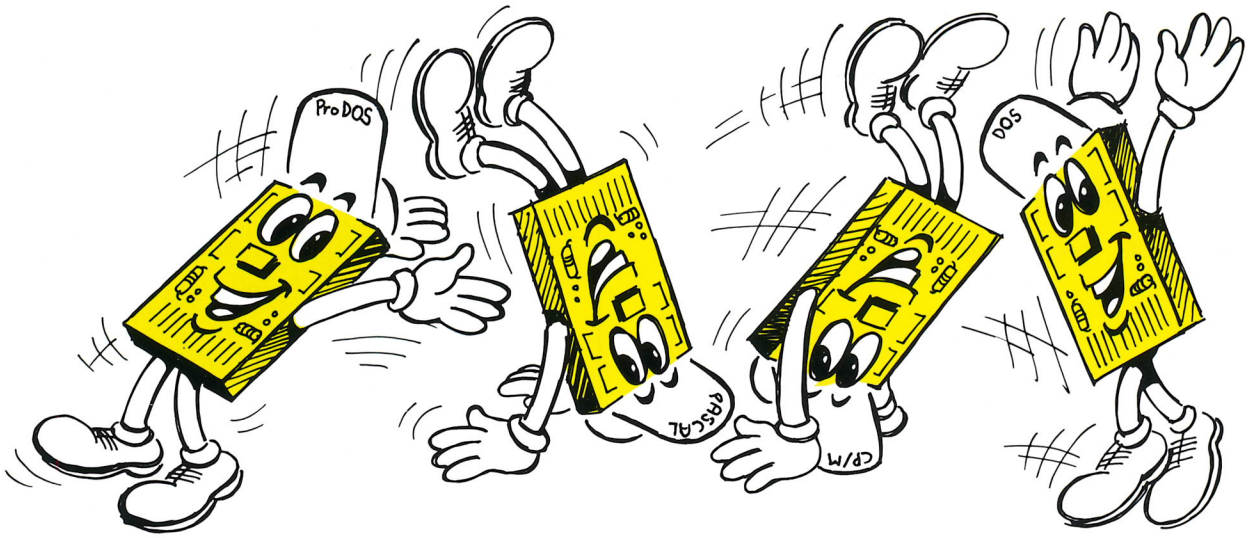

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